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A TEXT-BOOK OF
MINOR SURGERY

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MINOR SURGERY

BY

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FORMERLY CHIEF IN SURGERY AT THE VANDERBILT CLINIC

ILLUSTRATED BY FOUR HUNDRED AND SEVEN ENGRAVINGS
FROM ORIGINAL DRAWINGS AND PHOTOGRAPHS

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1909

THIS BOOK IS DEDICATED TO

THE MAN AT THE POINT OF THE KNIFE

FOR HIS GRIT AND PATIENCE, AND ESPECIALLY FOR
HIS WILLINGNESS TO BE PHOTOGRAPHED
THAT OTHERS MAY PROFIT BY
HIS MISFORTUNE

8275

PREFACE

In preparing this "Minor Surgery," it has been my purpose to apply to the less serious, every-day problems of surgical practise the new knowledge which the discoveries of the last twenty-five years have revealed. During this period the advances in diagnosis and treatment have rendered necessary a new surgical literature, and many excellent text-books have appeared, in one, two, and four volumes. In these the more serious surgical conditions are exhaustively discussed, while the treatment of the lesser ailments—the minor surgery which forms the bulk of surgical practise—is condensed into a chapter or two, in which methods of treatment long since outgrown still find their place. Nor is the importance of minor surgery recognized in the curriculum of our medical schools.

And yet this neglected field of minor surgery is the only one into which the average practitioner will ever enter, and is also the one in which most surgeons will find the majority of their patients. What wonder then that the physician, untaught and unread in minor surgery, fails to achieve good results, and that more bad surgery is performed upon the hand than upon the organs of the abdomen?

Impressed by the need of a text-book which describes in detail the manifold lesser accidents and surgical diseases which the general practitioner is called upon to treat, I commenced eight years ago the preparation of such a book. It has been rewritten several times, until hardly a page of the original manuscript remains; and it appears now in its development, somewhat larger, but the same in purpose as when it was first conceived.

If this "Minor Surgery" fails to meet the expectations of the reader, this fault does not lie in the author's lack of experience; for I had the richest opportunity for the preparation of just such a book in a ten years' almost daily service in the Surgical Department of the

Vanderbilt Clinic, with an average annual attendance of abou thousand new patients. Besides this I have enjoyed the adva which come from teaching both minor surgery and general s in the College of Physicians and Surgeons, and from surgi tendance in the Randall's Island Hospitals, the New York Cit pital, and the New York Polyclinic Hospital.

I have striven to present in compact form the results of t perience and the best that has been written in books, magazin journals, taking with free hand from every available source. list of the articles consulted would fill several pages. Very thors' names are mentioned because such simple procedures herein described must often suggest themselves to many min all owe so much to our predecessors.

The aim has been to illustrate by photographs as far as Too often medical illustrations show what might be, rath what is; for the difficulties of making clinical photographs su clear for good reproduction are tremendous. Mr. H. C. I has aided me very much in this part of the work, and has nished all of the drawings. My thanks are also due to D McKenzie for many good photographs made while he was a in my clinic; and to Mr. B. F. Puffer, who took for me t graphs to illustrate the chapter on bandaging.

EDWARD MILTON

136 WEST FORTY-EIGHTH STREET,
NEW YORK.

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SECTION I

AFFECTIONS OF THE HEAD

CHAPTER I

INJURIES OF THE HEAD

General Considerations.—It is sometimes difficult to determine the extent of an injury to the head either from the history of the accident or from the symptoms. The following two cases from the author's experience will illustrate this fact:

A girl fell backward down some stone steps, striking her head on the edge of one of them. Blood flowed freely from a wound in the scalp, and she walked to the hospital to have it dressed. There was no shock, nor any other symptom indicating that she had suffered serious injury, and yet retraction of the edges of the wound showed that there was a compound depressed fracture of the skull.

A man of middle age, pushed by a horse, fell against a sloping bank of earth. He was apparently uninjured except for an insignificant contusion of the head. Yet subsequent events showed that this slight accident had ruptured a blood-vessel within the skull, as a result of which, many days afterward, the first symptoms of paralysis developed and progressed to complete unconsciousness.

Such cases are a warning against a hasty diagnosis in head injuries. Every patient whose head has been injured should be carefully examined, and kept under observation for two or three days, as otherwise serious complications are likely to be overlooked. This is especially important if no clear history of the accident can be obtained, either because the patient is suffering from intoxication or for any other reason.

Contusions.—The scalp is firm and well protected by hair from external injury. It is loosely attached to the skull, but the absence of fatty tissue between it and the bone makes it more liable to suffer in the case of a sharp blow. A co scalp may or may not be accompanied by a great If the swelling is discrete and evenly curved it is the pouring out of blood underneath the scalp, a he The eyelids, nose, and lips are all frequently the se with marked ecchymosis.

Treatment.—If the patient is seen soon afte very hot, wet compresses (p. 7) should be applied in place with moderate pressure in order to reliev vent edema and hemorrhage. Later, a wet dres of aluminum, four per cent solution, may be app infection and facilitate recovery. The hair, even o not be needlessly sacrificed. In many cases a pati by the appearance of a black eye, and desires to color of the skin restored as quickly as possible. applications are of benefit, and in a day or two the lowed by very gentle massage in the direction of rent, for this will facilitate the absorption of t blood. Considerable improvement in appearance by painting over the blackened area with theatric with oxid of zinc ointment. If the latter is used be wiped off and a little face powder dusted over shiny, greasy appearance which the ointment cau

Subconjunctival Ecchymosis.—Blows upon the lowed by an accumulation of blood beneath the co of an eyelid or of the eyeball, frequently exte the iris. Such a hemorrhage, due to rupture o vessel, also occurs as a result of violent coughing o cially in persons past middle life. It is also a s ture of the skull, in which case the blood trickles of the orbit and collects beneath the conjunctiva. the conjunctiva of the eyeball is so freely suppl that it remains a bright red.

The treatment for this ecchymosis is similar given for contusions of the face. It is only fair t ment has little effect in hastening the resorption sated blood, which usually requires from ten da

Hematoma.—Hemorrhage occurring beneat neath the periosteum, sufficiently free to produce most common at those points at which the scalp is most exposed to blows, *viz.*, over the parietal, frontal, and occipital bones, about where a man's hat touches his head. The surface of a hematoma is even and rounded. If small, the swelling rises more sharply from the surrounding surface than if extensive. Edema of the skin may be slight or wholly wanting. Fluctuation can usually be obtained. The overlying skin may be discolored by an accompanying contusion, but even if this is absent the hematoma will have a bluish look, due to the underlying blood. Absorption of so large a quantity of blood takes place very slowly, but the scalp is so abundantly supplied with blood-vessels that necrosis of the skin rarely follows. However, the time of recovery will be much shortened by removal of the effused blood. Suppuration is an occasional complication in both operated and non-operated patients.

TREATMENT.—Removal of the effused blood may be accomplished by aspiration if the contents are sufficiently fluid, or the fluid and clotted blood may be turned out through a small incision. The head should be prepared by a careful washing with hot water and soap, and then with alcohol. If an incision is to be made it is better to shave a small area, but if sufficient care is given to cleansing the scalp and hair in the vicinity, primary union may be obtained without this. A scalpel, clamps, two small hooked retractors, thumb-forceps, and scissors are the only instruments needed. They should be boiled before using. The skin is divided, one side of the wound is elevated with a retractor or with forceps, and the clotted blood is thoroughly wiped out with pieces of absorbent cotton wrung out in weak bichloride of mercury solution (1: 5,000). The fingers of the operator should not come in contact with the wound. The edges of the incision should then be drawn together with sutures of fine black silk or horsehair, and a firm dressing of dry, sterile gauze applied to keep the involved tissue planes in contact and to prevent exudation. A similar dressing should be applied after aspiration. The dressing should be changed on the following day and the pressure kept up for several days. The blood in a recent hematoma is not easily aspirated.

Whether or not drainage is required will depend upon circumstances. A folded gutta-percha drain, if removed in two days, does not materially delay union, and leaves no scar. Such a drain should be inserted at the time of operation, if it seems likely that

the blood will reaccumulate. It should certainly
the first dressing, if the wound was not drained at
there has been a partial reaccumulation of blood.

Hematoma in the New Born.—Blood often colle
periosteum and the skull of a child that is delive
It may be difficult to distinguish between a hemato
acter and a contusion with edema. Two or three d
the edema of the scalp has subsided, but a fluct
persists beneath it, the diagnosis is clear. Thi
should be evacuated through a small incision, in
scribed above, because its resorption is very slow
periosteum lifted from the skull continues to form
this manner in some cases a prominent and perma
of the skull develops. Hence the desirability of ren
as soon as possible, and of keeping the loosened per
against the s
days until it

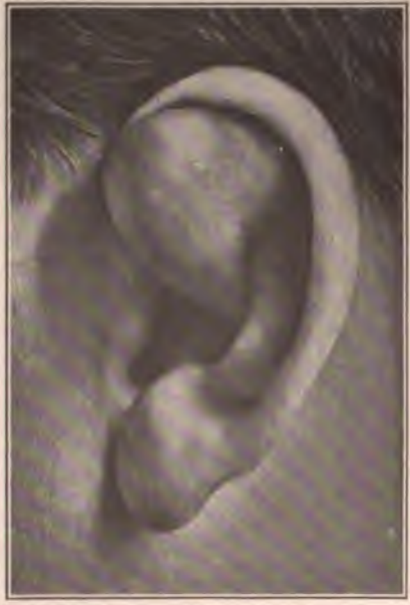

FIG. 1.—HEMATOMA OF EAR FROM A BLOW. The perichondrium is lifted over a considerable portion of the pinna.

Hematoma
Ear). — Blow
may give rise
beneath the
The effused
rounded fluc
(Figs. 1 and
stretch the ea
normal size
change its ap
may be confi
portion of the
It is more oft
posterior. Al
effused blood
slow, and the
therefore be p
the blood clots
moved, and
tured. The skin of the ear has a good blood supp
in it heal promptly if the edges are accurately a
sutures.

Hemorrhage from the Nose.—Hemorrhage from the nose, or epistaxis, may follow a blow either with or without fracture of the nasal bones, or it may result from picking at the nose or the removal of dried secretion. It is one of the forms of vicarious menstruation. It is also a symptom of tuberculosis, of syphilis and malignant tumors, and of many fevers. It is one of the signs of fracture of the base of the skull.

The blood may flow in drops or in a steady stream, or occasionally it may be seen to spurt from an artery of the septum.

TREATMENT.—In the majority of instances the hemorrhage will cease spontaneously in a few minutes. The patient should not lean forward nor lie upon his face. The head should be held erect, or it should be bent slightly backward, so that the blood may accumulate and form a clot in the nostril. If the blood trickles into the naso-pharynx, it should be quietly expectorated. The patient should avoid any attempt to clear the nostrils by blowing. The application of cold in the shape of ice or some metallic object, like a large door-key, to the back of the neck is a well-tried household remedy which has often proved effective. The holding of ice in the mouth or snuffing ice-water up into the nostrils may also suffice to stop the bleeding. Many popular remedies have doubtless won fame because of the tendency of the hemorrhage in most cases to cease in a few minutes. In adults of a plethoric type frequent nosebleed seems to be really beneficial by reducing the tension in the arteries. There are cases, however, in which the hemorrhage is alarming, and the patient may even be in danger of

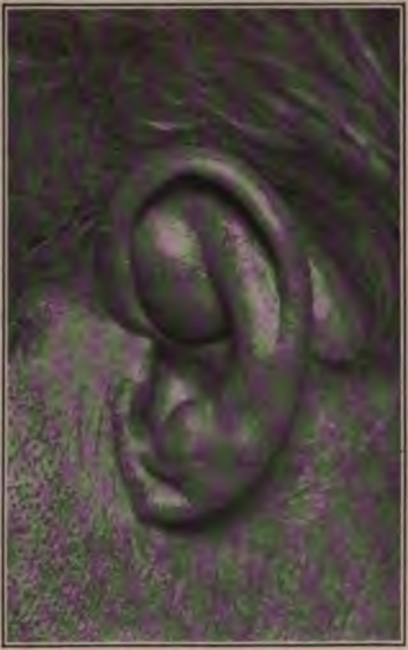

FIG. 2.—SMALL HEMATOMA OF EAR FOLLOWING A BLOW THREE WEEKS PREVIOUS. Patient a man aged forty-one years.

bleeding to death. In other cases the bleeding is so
it becomes desirable to check it at once.

To check the hemorrhage the nostril from whi
rhage comes should be sponged clean and a systemat
for the bleeding point. The head should be tipped
the blood to flow out of the posterior nares. In t
anterior nares can be carefully inspected. The blee
often be found low down upon the septum, abou
above the floor of the nasal passage and half an inc
the anterior orifice. Here it may be touched w
caustic or by a hot probe, the shaft of which has
in order to avoid burning the tip of the nose, or by
of a thermo-cautery. By far the best styptic is a
extract of the suprarenal gland. Cotton moiste
should be applied to the bleeding spot, or a
(1 : 10,000) may be snuffed up the nostril. Per
gen is another excellent styptic.

If the bleeding cannot be stopped in one of the
it may be necessary to plug the nasal cavity throu
nares. A narrow strip of gauze about two feet long
peroxide of hydrogen and squeezed dry. The an
dilated and the end of the strip passed well back i
slender forceps. The packing is continued from
until the cavity has been filled. Should this pack
trol the hemorrhage, the gauze should be withdraw
terior nares plugged. This disagreeable procedure
plished by passing through the anterior nares a ca
rubber tube, through the eye of which a thread h
As the catheter appears in the pharynx the thread
with a hook and one end of it drawn out of th
catheter is then withdrawn, the string remaini
through the nose and out of the mouth. A speci
strument for this purpose, known as Bellocq's canul
spring which carries the thread forward beneath
thus making its extraction more easy. When the
in position, a pledget of cotton may be tied to
emerges from the mouth, and passed well into the
by drawing the string through the nose. The
should then be plugged with gauze or cotton. B

string should be secured by tying them together or fastening them on the cheek by adhesive plaster. Otherwise there may be difficulty in removing the posterior plug. This procedure is at best a clumsy method of stopping hemorrhage, and should not be resorted to unless other measures fail.

When once a clot has formed and hemorrhage has ceased, both patient and physician should for a day or two resist the temptation to remove the tampon until the secretions of the nose lift it from the surface of the mucous membrane, so that it can be extracted easily and without starting fresh hemorrhage. After that, gentle irrigation with a weak alkaline solution should be employed to cleanse the nostril.

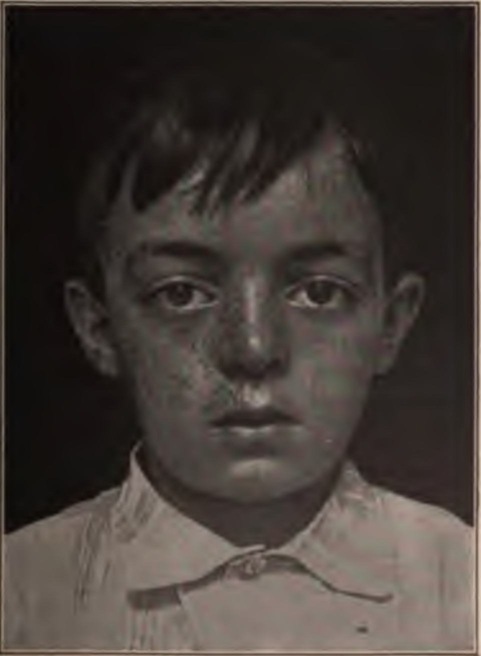

FIG. 3.—POWDER GRAINS IN FACE FROM A RECENT EXPLOSION.

Abrasions.—Abrasions of the scalp and face are of importance as possible sources of infection. Abrasions of the face are important also because they may contain particles of sand, coal dust, etc., which healing in the wound may permanently disfigure the patient. Hence the necessity that all abrasions of the head should be cleansed thoroughly and then covered with gauze moistened with a weak antiseptic, such as aluminum acetate (four per cent solution) or creolin (1:200) held in place by a gauze bandage. The dressing should be moistened with cold water every two hours. If kept moist in this way the dressing can be changed every day without irritating the wound. It is more easy to keep a wound of the scalp clean if a border an inch wide has been shaved around it. In a day or two the risk of infection will have passed, and the abrasions may dry, or they may be covered by boracic acid oint epithelium has formed.

Removal of Powder Grains.—In abrasions of th geon's attention should be directed to the removal o of dirt, a stances, of sand, over by form per marks i tattooin pecially powder are so and nun hopeless pick th one. It tant, ho be remo to give anesthet scrub th with a every t has bee (Figs. once the over the sible to get them all out by cutting or caustics marked scars.

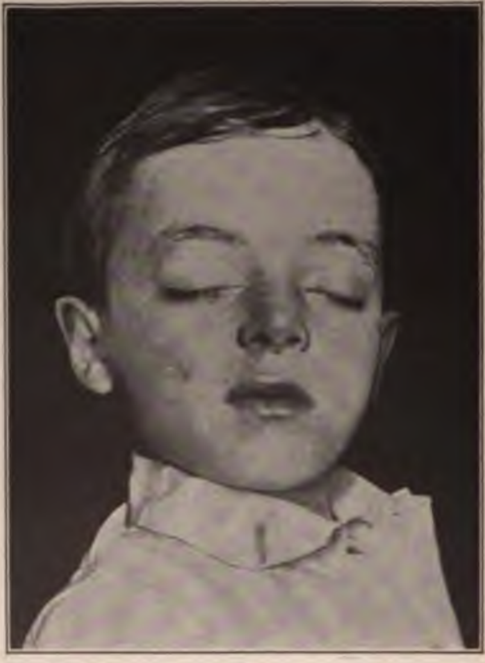

FIG. 4.—POWDER GRAINS REMOVED BY SCRUBBING WITH A STIFF BRUSH WHILE THE PATIENT IS FULLY ETHERIZED. All the grains were removed in this manner. The dark spots in the photograph are the slight resultant wounds. There was no permanent scar.

Foreign Bodies.—Foreign bodies frequently l ear, nose, or mouth, and the rules for their extracti different situations. Foreign bodies in wounds a page 14.

Foreign Bodies in the Eye.—A patient will us diagnosis of a foreign body in the eye by a feeling comfort. Frequently he can locate a small foreign exactness, although usually unable to say whether it is in the eyelid or eyeball.

The eye should be examined in a good light, first by direct light, and then if the foreign body is not discovered, by side light. The lower lid should be depressed to permit examination of the lower half of the eye. The patient should then be directed to look downward. The eyelashes of the upper lid are seized, and the lid is everted by lifting its lower edge outward and upward at the same time that the upper margin of the tarsal cartilage is depressed with the tip of a finger, or with the end of a glass rod or pencil.

When the foreign body is discovered, it may be wiped away with a bit of absorbent cotton wrung out of saline solution, or out of a solution of boracic acid; or it may be removed with a blunt instrument, such as a spud or a match whittled to a not too fine point.

If the cinder or minute particle of steel or glass is embedded in the cornea, it is well to drop a little weak cocain solution (one or two per cent) into the eye to assist the patient in keeping the eyeball quiet while the operator works out every particle of the foreign body.

Most writers upon diseases of the eye advocate the use of fairly strong antiseptics for the purpose of disinfecting the wound in which the foreign body lay. This method of treatment was formerly advocated in the case of larger wounds of the body, but it is now pretty generally understood by surgeons that such solutions have little effect other than that of the fluid itself. The rational procedure, therefore, is to bathe the eye with a weak antiseptic, such as a half saturated solution of boracic acid, or a normal saline solution every two or three hours, and to trust to the antiseptic action of the tears and of the internal fluids of the body to protect the eye from infection. Pain is much relieved by the application of ice cloths, and protection of the eye from strong light.

If the foreign body has penetrated more deeply into the eye than the cornea, the aim of treatment is to remove it with as little damage to the eyeball as possible. A patient with such a serious lesion should be treated from the first by a specialist when circumstances permit. Some writers upon the eye praise the use of a magnet for the removal of bits of steel and iron, while others say that it is of no use, even when such a foreign bod superficially.

Foreign Bodies in the Ear and Nose.—Beans, shoe other objects are poked into the ear or nose by child are smooth they may set up no irritation, but gener enough swelling of the mucous membrane to reduce t opening and make their extraction difficult. If a fo sharp, so that the mucous membrane is broken, eithe or later, there will be a continuous discharge from nostril, or from the ear, as the case may be. A p lateral nasal discharge in the case of a child alwa foreign body.

The amount of pain varies in different cases, acc situation, size, and shape of the article, and the amo done at the time of its entrance.

The diagnosis may be suspected from the history but it rests chiefly upon the results of direct inspecti suitable speculum. If the patient is a young child, a thesia is desirable for this examination as well as f treatment.

Treatment.—It is absolutely necessary that the should be still during attempts at extraction even if thesia has to be employed to accomplish this object. body is one which may be firmly grasped with mo ceps, it can be slowly and steadily extracted. The struments are shown in Figure 5. If the foreign b and hard as, for instance, a round glass bead, a maker's wax may be utilized to obtain a hold upon or blunt hook of bent wire may be passed alongside substances, such as insects, may possibly be floate ear on the surface of olive oil poured into the n is also a good way to drown an insect, and stop i the ear.

One of the commonest foreign bodies the surgeon to extract from the ear is a mass of ear-wax. Norn which is secreted in the ear works outward as a thin, der, the outer edges of which dry up and break off an overzealous individual attempts to free his ear of of a slender cone, for example, the twisted corner of it sometimes happens that the edges of the thin cylinder of wax are pushed inward from time to time until a large ball of wax is formed. This is not usually noticed until some jar dislodges it and it falls against the drum-membrane, causing a constant buzzing sound and a general feeling of uneasiness inside the head. As this continues and hearing is possibly interfered with, the individual seeks medical aid, under the supposition that he has some

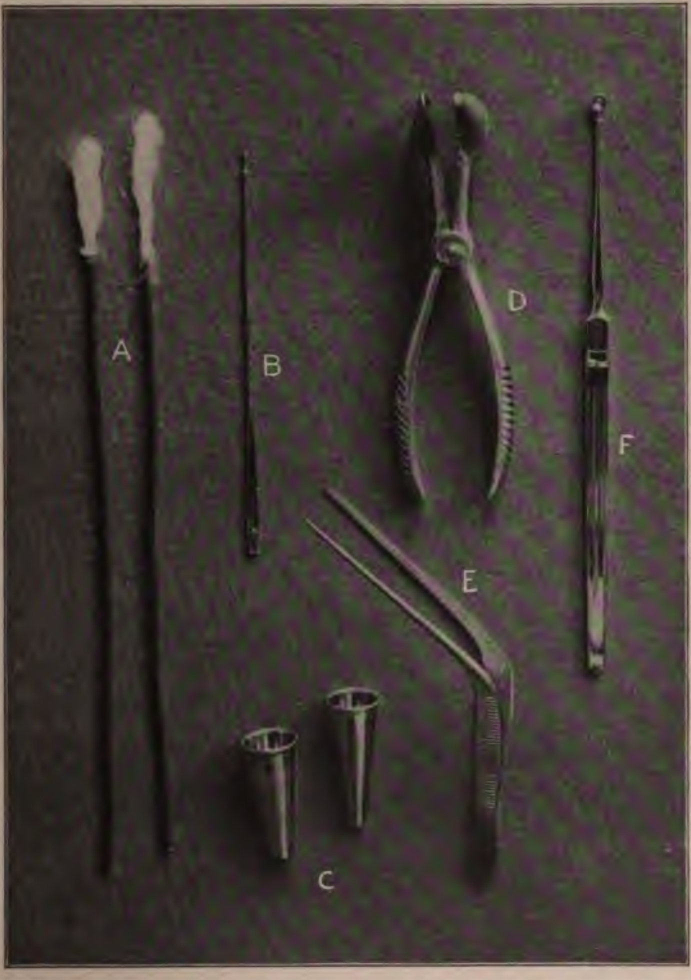

Fig. 5.—Instruments for the Extraction of Foreign Bodies from the Nose and Ear: *A*, Cotton carriers made of flattened copper wire; *B*, Pure silver slender probe; *C*, Ear specula; *D*, Nasal speculum; *E*, Forceps bent at a convenient angle; *F*, Curette.

serious ear trouble. From the symptoms alone the d usually be made.

An examination through an ear speculum reveal wax at a greater or less depth from the surface. large a speculum as the ear will conveniently receive, ceps bent at a suitable angle may be passed into t they touch the wax (Fig. 5). The ball may be number of fragments drawn outward through the spe success of this method depends as much upon the c the wax as upon the dexterity of the surgeon. If th it can all be removed in a few minutes. If it is sc of it can be extracted in this manner, and removal has to be resorted to. A fountain syringe or irrigator a warm dilute solution of bicarbonate of soda (a teas pint) and placed high enough to give slight force to stream, which is then directed, either with or witho lum, full against the plug of wax, the ear being lifted backward to dilate and straighten the canal. The wa viscid by the fluid, and is separated from the walls to a certain extent, and in most cases half an hou interrupted by occasional extraction of fragments wit or with the curette, will suffice to empty the meatus procedure can be resumed the following day. Whe other foreign body has been removed, the ear should examined for the presence of inflammation. If t merely excoriated, an occasional antiseptic irrigatic with powdered boracic acid is sufficient treatment.

Foreign Bodies in the Mouth and Throat.—Small may become lodged in some crevice of the mouth or sharp, they may penetrate the mucous membrane, a the patient's efforts to eject or swallow them. A splinter, or a fragment of straw is the object tha comes embedded.

The sensations of the patient are in most cases a to the location of the foreign body. It is possible object to scratch the throat during the act of swallowi behind it the sensation of a foreign body. It is however, for the patient to be mistaken in this wa physician ought in every case to make an examin strong reflected or direct light and a throat mirror. The latter is of the greatest service in hunting for small, colorless objects, since it enables the examiner to inspect the tonsil and the pillars of the fauces from different angles. These are the situations in which most small foreign bodies become lodged. When found, the foreign body can be extracted with the forceps, or worked loose with a probe or bent wire. If the search is fruitless, it should be resumed on the following day, provided the symptoms in the meantime have not subsided.

Foreign bodies in the larynx and esophagus are described on page 115.

Wounds.—The different varieties of wounds—incised, lacerated, et cetera—are found with frequency upon all portions of the head. The blood supply of the scalp and of the skin of the face is so free that no matter how jagged a wound may be, the vitality of its points is usually preserved.

Owing to the smooth, hard surface of the skull, a blow upon the scalp with a blunt instrument, such as a policeman's club, will produce a fairly clean cut wound, almost like that made with a knife. A careful inspection of its edges, however, will show a contused area more or less circular, and about an inch in diameter, which represents the area of contact of the instrument with which the blow was given.

TREATMENT.—The first object of treatment is to control hemorrhage, either by pressure or ligation of the bleeding vessels; the second is to determine the extent of the wound, the third to remove any foreign bodies which may be present, and the fourth to approximate, by suture or otherwise, the tissues which have been divided, whether skin or deeper structures.

It should be an invariable rule never to pass a probe into a wound, especially a wound of the scalp, until the skin has been cleaned as for operation; otherwise the probe may spread infection to the deeper portions of the wound, which in the particular case mentioned may be the surface of the brain.

The skin should be thoroughly washed with soap and water, then with some solvent of grease, such as ether, or turpentine followed by alcohol, and dried by gauze sponges or cotton swabs wrung out of an antiseptic solution (p. 34). The wound should be cleansed with saline solution, or stronger solutions, according to circumstances. Its edges should be retracted, and bility of deep injury determined. Small foreign bodie removed.

If a foreign body such as a splinter passes under t sinus made by it should be split up and thoroughly c if allowed to remain undisturbed it is almost certain t puration and delay recovery. A bullet of small calibe trate the scalp at one point, pass along outside of th emerge at another, or remain between the periosteum a In such a case the bullet should be removed by an inci the sinus irrigated with peroxid of hydrogen soluti weaker, and 1:2,000 bichlorid solution, and press throughout its length except at its ends, which should by small strips of gutta-percha tissue or gauze. In union can ordinarily be secured without dividing the scalp.

Most small wounds of the face and scalp should without drainage, or at most, a flat gutta-percha drain should be employed (Fig. 306). Carefully appl obtained by bandaging a dry compress of gauze to t prevent reaccumulation of blood in the wound.

While it is generally true that all the ragged points of the face or scalp will live, it is better for the sak scar to trim the edges of the wound so that they may approximated. Especial attention should be given to of hairs whose roots are often twisted and displace injuries. Horsehair or fine black silk is the best mat suture.

Some surgeons have advocated a subcuticular sutu introduced with a curved needle which passes into an skin, first on one side of the wound and then on the ot reaching the surface. This suture is more difficult o than other sutures, and it sometimes fails to appro rately the overlying epidermis. If the thread used rupted suture is a very fine black sewing-silk (No. sutures are taken out in from two to four days, no pern due to the punctures will remain.

Wounds of the Eye.—If a laceration extends thro skin and conjunctiva of the eyelid, some of the sutures through both structures, so as to approximate the edges of the conjunctiva. Other sutures should be placed in the skin only. All of them should be removable from the outside. In treating wounds of the eyeball, repair with the least disturbance of the normal relations should be the aim of the operator. Protruding portions of the iris should be snipped off. Wounds of the sclerotic coat, if sufficiently large, should be sutured with the finest catgut. The eye should be washed with Thiersch's solution (salicylic acid 2, boric acid 12, boiled water 1,000 parts) one-half strength, or a half-saturated solution of boracic acid, or a normal salt solution. A light pad of gauze moistened with one of these solutions should be applied. The bandage (Fig. 326) should be light so that evaporation may keep the eye cool. No rubber protective is permissible. The moisture should be kept up by adding from time to time more of the solution or cold boiled water. If the injury is serious the patient should remain in bed until repair is well established. The services of an ophthalmic surgeon should be obtained in these cases whenever possible.

Wounds of the Mouth.—Wounds within the mouth are constantly filled with bacteria, some of them pathogenic. Nevertheless, they usually heal with little delay, owing to constant moisture and the extremely free blood supply. It is rare that the surgeon is called upon to treat a bitten tongue or cheek. If, however, so large a flap has been separated from the main tissue that untreated it would cause a permanent roughness in the mouth, one or more sutures of fine black silk should be inserted with a curved needle. Plain catgut soon swells and softens and loses its grip. Catgut prepared so as to resist moisture (e. g., chromicized) is stiff and unpleasant; fine silk, dyed black so as to be readily seen, is therefore the best suture material for the mouth.

If the lip or cheek is cut through, cutaneous sutures passed through all the tissues except the mucous membrane will sufficiently hold the parts in place, or the mucous membrane may first be sutured with catgut or silk, the knots being tied inside the mouth. If silk is used the sutures should be so placed that their extraction will be easy. The mouth should be kept clean by rinsing with a mild antiseptic solution, and, if necessary, remnants of food should be wiped with wet cotton swabs from the vicinity of the wound.

Steno's duct, or the facial nerve, may be divide
of the cheek (Fig. 6). Immediate suture should b
or even late suture if the accident is overlooked at
two divided
Steno's duct
separated b
the anterio
the duct ca
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then dilat
The channe
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so, or a lig
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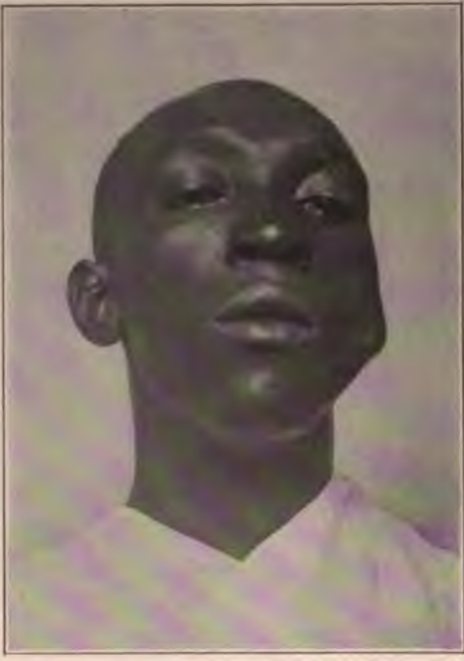

FIG. 6.—DIVISION OF STENO'S DUCT BY A RAZOR. The skin was sutured and the division of the duct was not noticed until the obstructing scar caused distention behind it. This patient was promptly cured by the method described above.

The paralysis of the mouth, and possibly also of th
to division of the facial nerve, can hardly be over
nerve should be sutured at once; see Chapter XIII fo

Wounds of the Periosteum.—In incised and punct
of the scalp, the periosteum is often injured. This
plication can be recognized by retraction of the edges
and inspection and probing of its deeper portion. I
overlying aponeurosis is divided, one may be misled in
that it is the periosteum. If the latter is also divid
will clearly detect the underlying bone. Such a wou
thoroughly examined, cleansed, and drained. It is be

union for a few days by the presence of a gauze drain than to suture the periosteum and run the risk of abscess formation beneath it. The mere exposure of the skull for a few days will not result in necrosis if suppuration does not coexist; whereas an infected punctured wound, for example over the eye, may be followed by suppuration under the periosteum which, if neglected, may pass through the skull and set up a fatal suppurative meningitis. Therefore the fresh wound should be only partially sutured, while a strip of gauze should reach to the periosteum in the center of the wound. This drain may be withdrawn in forty-eight hours, and if the wound is still clean it may be allowed to close; if it is suppurating it should be washed out with mild antiseptics and drained again, and a wet dressing applied.

Fractures.—Fracture of the Skull.—In many instances it is impossible to diagnose a simple fracture of the skull except by accompanying signs. These are local pain and tenderness, hemorrhage—the blood appearing in the orbit or coming from the ear—headache, shock, partial paralysis, pupils irregularly contracted or dilated, and partial or complete unconsciousness. Shock, even to complete unconsciousness, may be present from concussion of the brain (really contusion of the brain) without fracture of the skull; and fracture of the skull, especially if it is caused by a fairly sharp instrument and if it involves bone which overlies the less important portions of the brain, may be unaccompanied by shock. This is especially true of the occipital region. Hemorrhage in the orbit, appearing usually under the conjunctiva, or from the nose (if fracture of the nose is absent), or from the ear, or appearing under the skin in these localities, is considered to be pathognomonic of fracture of the base of the skull. Under such circumstances operative treatment is out of the question. Absolute quiet in a cool, dark room, with external heat to the extremities, and cardiac stimulants, if necessary, are the best means to be employed. If external wounds are present the most rigid asepsis should be observed in their treatment. If the lesion in the skull is extensive or a portion of the bone is depressed, it is better not to attempt repair at the time of the accident, but simply to protect the wound by a moist antiseptic, or dry sterile dressing, until arrangements for a formidable operation can be completed.

Fluctuating hematoma of the scalp, surrounded by a ring of resistant edema, may give the impression that the bone in its center is depressed. This error is to be avoided by noting the natural curve of the skull outside of the edematous area.

Fracture into a Frontal Sinus.—A fracture of the frontal bone just about the orbit may involve only the outer wall of the frontal sinus. This is not usually a serious lesion, but the bone should be replaced in its normal position so that permanent disfigurement may be avoided.

To accomplish this it may be necessary to make an incision beneath the eyebrow.

Fracture of the Malar Bone.—This injury is due to direct violence, and the bone is almost invariably displaced backward so that one cheek is less prominent than the other (Fig. 7).

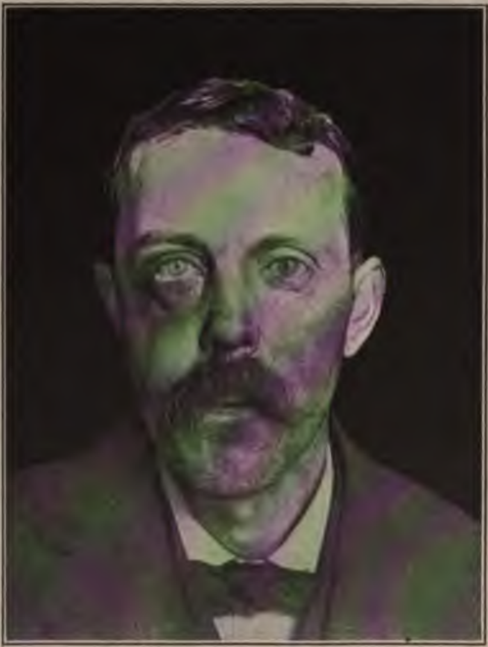

FIG. 7.—FRACTURE OF RIGHT MALAR BONE WITH DEPRESSION FROM BLOW.

To replace it in position, anesthetize the patient, chisel a hole into the antrum just above the first bicuspid tooth and introduce a curved steel sound. With this instrument as a lever, firm, steady pressure may be exerted upon the inner surface of the malar until it is brought into its normal position. A mouth wash is the only after treatment required.

Fracture of the Nasal Bones.—The nose is frequently injured by blows and falls, so that the nasal bones may be fractured, or the cartilages torn loose from them. An injury of this sort is usually followed by more or less hemorrhage from the nares. There is also subcutaneous hemorrhage and edema, so that it is difficult to determine from external examination alone whether the rigid structures have been altered. Gentle manipulation of the bridge of the nose will usually elicit crepitus if there is a fracture. This should be combined with inspection of the nares through a bivalve speculum. Deformity may of course have existed previous to the injury, and the patient should be questioned upon this point.

The hemorrhage stops in a few minutes, and the pain is slight; but the patient may be distressed by his appearance, or by the fact that the swelling and hemorrhage prevent him from breathing through his nose; but both nares are not usually obstructed.

TREATMENT.—The chief object of treatment is the reduction of deformity, and the maintenance of correct relations for a few days. Whenever possible, existing deformity should be so corrected or overcorrected that there is no further tendency for the bones to slip out of place. A blunt steel sound, or some similar instrument passed into the nostril, is of assistance in correcting displacement.

If deformity tends to recur, it may be necessary to insert a hollow, perforated rubber cone into one nostril, or to apply an external splint. This can be made of dental composition, softened in hot water, and molded to the nose, or a pad of gutta-percha tissue may be similarly employed. As the swelling diminishes, the splint must be remolded. The surgeon can then better judge whether all deformity has been corrected, and if not this should be accomplished before union becomes solid. If the patient is seen several times with this object in view, it will rarely be necessary to make use of a complicated nasal splint, or to scar the face by passing a hat pin directly through the nose.

Fracture of the Superior Maxilla.—This is one of the less common fractures. Deformity is easily overcome, and after reduction the fragments will usually remain in a correct position, since there are no strong muscles tending to displace them. As an additional safeguard, wires and threads may be used to bind together teeth attached to the fragment, and those of the remaining part of the superior maxilla, as described below in connection with fracture of the inferior maxilla.

Fracture of the Inferior Maxilla or Mandible.—This injury is very common, and often seriously affects the patient's health. Moreover, the difficulty of keeping the fragments in correct position often taxes the ingenuity of the surgeon to the utmost. The fracture is due to direct violence, and almost always to blows re-

ceived in a fight. The line of fracture usually passe
body of the jaw, back of the canine or the bicuspid to
however, occur at other places, and often there is a sec
either on the other side, or possibly on the same side,
it may be above the angle of the jaw. If the fractu
in that portion of the jaw occupied by the teeth, it is
compound into the mouth.

Diagnosis is made from inspection and manipulati
from the subjective symptoms of pain and disabili
local swelling and tenderness. Inspection of the gum
show a break in the continuity of the mucous men
roots of the teeth. The patient cannot open his mo
can he bite on a hard substance, for example a cork.
open and close the mouth may produce motion at th
ture, shown by changes in the relation of the teeth
of the break. Such displacements can be readily pr
examiner, if, grasping the jaw between his thumb
the patient's chin and two fingers placed on the in
rocks it from side to side.

The disability due to this fracture is great.
absolutely unable to chew solid food, even if it were
him do so, or to open the jaw except to a slight exte
vents him from sleeping, and abnormal fermentati
mouth increase the swelling and inflammation, and
gust and discomfort.

TREATMENT.—The first step in treatment is the
tion of the fragments, under a general anesthetic if
some cases this is a very simple procedure, and th
bone when reduced show no tendency to become
other cases reduction is easy, but the moment that th
go of the jaw displacement recurs. In a third clas
feet reduction is impossible, or can only be accom
exercise of considerable force. This means that a to
loosened and wedged between the fragments, or that
placed small fragment of bone which has intervene
manner to prevent the reduction. Such offending
ment, should of course be removed.

The simplest method of keeping the fractured en
in apposition is to bandage the jaws firmly togethe

the upper jaw act as a splint for the lower one. A four-tailed bandage with a slit or narrow ellipse cut in its center through which the point of the chin protrudes sufficiently to keep the bandage from slipping, is tied across the occiput and over the forehead, one end being left long in each situation (Fig. 8). These two ends are then tied together over the top of the head. The bandage after this application is shown in Figure 328, Chapter XXI. In this manner any desired amount of pressure can be produced upon the jaw, the pull being both backward and upward. This method of treatment makes it difficult for a patient to keep his mouth in proper condition, and interferes with feeding, as he has to take fluid nourishment through a tube. Pressure of the bandage over the seat of fracture often adds to the patient's discomfort; but it is by far the commonest method employed on account of its ready application. There are cases in which it answers the purpose admirably, and the patient is even able to open his teeth sufficiently to brush them without disturbing the fractured ends. In other cases the bandage is a miserable failure. Non-success is usually due to the fact that reduction has been imperfectly accomplished, or to the fact that the patient has not two full sets of teeth. If a person has all of his natural teeth, pressure of one set against the other, and the repeated slight blows given by the act of chewing will, during the later weeks of convalescence, correct any slight irregularity of the lower jaw which still exists, provided that reduction does not require much force, and that there are at least two teeth back of the line of fracture.

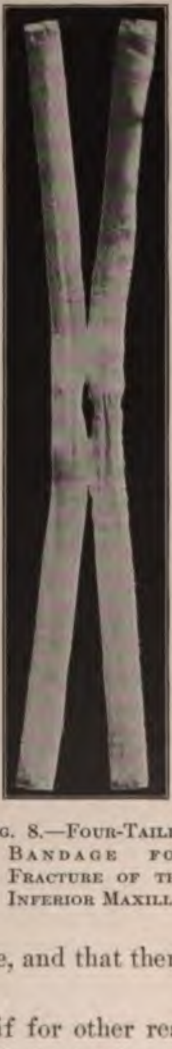

FIG. 8.—FOUR-TAILED BANDAGE FOR FRACTURE OF THE INFERIOR MAXILLA.

If this simple treatment does not succeed, or if for other reasons a more exact method of treatment is indicated, the teeth may be wired together. For this purpose two flat wires should be passed along the lower teeth, one inside of them and one outside of them, and they should be lashed to the teeth and to each other

by threads; but no threads should be placed around
nearest the fracture, for they are usually loosened a
of enduring the strain. In many cases absence of
situation of the fracture far back, makes this plan
impossible.

Fracture of the lower jaw may be treated by me
terdental splint. Success in the use of this form
depends not a little upon the manual dexterity of the s
first step is to secure a good impression of the teeth
the whole of the lower jaw. This impression may re
by means of modeling composition such as dentists
not at all necessary that the fracture be reduced whe
sion is taken. It is just as easy to set the fractu
pression as it is in the jaw, but the fracture must l
course, before the splint is applied. The impressio
the line of the gums both inside and outside the teet
extend well back to the angle of the jaw on the f
From such an impression, if well made, an excelle
be ordered from any dental manufacturing house at
dollars or more. Counter-pressure is obtained by t
bandage already described, or the splint may be p
the lower jaw by means of a pad or a bit of board wh
to the splint by a broad spring curling over the chin.
is to fix wires in the interdental splint. These
the angles of the mouth and turn backward along tl
are bound together, the bandage passing beneath th
sure will be more exact if a board nearly as long a
between the wires is placed under the jaw. If a
character fits accurately, it enables the patient to o
and often to chew soft food, if the interdental spli
fit both upper and lower teeth. In many cases, tl
keep the broken bone in place without the use of a l

The form of apparatus selected must be worn
or more, depending upon the amount of tendency t
and the rapidity with which the ends of the bone u
favorable cases it will be several weeks before the p
the full power of the jaw and the ability to open wi
If the line of union is a correct one, the surgeon ne
to promise complete restoration of function.

Complications of Fracture of the Lower Jaw.—Fracture of the lower jaw is usually compound into the mouth. It is therefore not surprising that infection sometimes develops. In a certain number of cases this is of mild character; the pus which forms is discharged into the mouth, the wound heals by granulation, and the union of the fractured bone, although delayed, is not otherwise interfered with. In a good many cases, however, an abscess forms which drains imperfectly and gives rise to pain, swelling and edema of the neck and possibly fluctuation below the margin of the jaw. This is an unfortunate complication, since it may lead to a sequestrum and greatly delay recovery, and possibly make it necessary to perform one or more operations to provide drainage or remove dead bone. It is therefore important to keep the mouth of every patient as clean as possible by the use of astringent and antiseptic mouth washes. If an abscess forms, it should be promptly drained within the mouth if good drainage can be thus secured, and if not, through an external incision. Such an incision should be parallel to the margin of the jaw, and just below it. If the fracture is near the center of the horizontal ramus, the possibility of division of the facial artery or vein should be borne in mind. A drain should be placed in the external wound, but should be of such a character as to favor the escape of pus, and not to prevent it. Frequent irrigation with a solution of peroxide of hydrogen (1 : 8) assists in keeping the wound free from bacteria. Meanwhile treatment of the fracture itself should be continued as described above.

A sinus which has formed spontaneously, or which follows an external incision for drainage usually lasts some weeks. No attempt should be made to close the opening in the skin until the deeper portion of the sinus has become filled by granulation. When this takes place, the opening in the skin will quickly close.

Persistence of the sinus means that some foreign material is present: either the loosened root of a tooth or a sequestrum of the bone itself. The opening should be enlarged, such foreign material removed, and another period of drainage instituted. Care should be taken not to break up newly formed bone, which is often thrown out around the sequestrum in great abundance in cases of compound fracture of the lower jaw.

Non-union of the mandible is almost unknown; therefore a persistent following out of the principles here outli to complete restoration. If the resulting scar is unne figuring by reason of its close attachment to the bo be removed; but not until some months have elapsed

Dislocation of the Jaw.—This is a rare ac is brought on by extreme gaping or laughter. T process on one or both sides slips forward out of its impossible to close the mouth, and the pain due to the ligaments is excessive. The patient should be and the jaw grasped firmly with two hands, the thum well wrapped about with bandage, are placed upon th Pressure downward and then backward will restore its correct position. In some persons dislocation of t place easily, owing to abnormal laxity of the ligam these circumstances reduction is readily accomplishe anesthetic. No after treatment is necessary.

There are certain long standing cases of unreduc of the jaw which cannot be reduced in the manner d for which resection of the articular portion of the b advised, or the bone may sometimes be dragged int specially contrived hook which is inserted through a in the cheek and is passed around the neck of th enables the surgeon to make very strong traction in th tageous manner.

Subluxation.—A few young men and girls—espec ter—complain of a partial dislocation of one or bo articulations every time the mouth is opened. This t at the period of development of the wisdom teeth, cases is due to it. The pain is slight. Some patients themselves benefited by the application of tincture small blisters. In most cases a spontaneous cure ta some months. Therefore nothing should be done wh manently stain or scar the skin.

CHAPTER II

INFLAMMATIONS OF THE HEAD

EFFECTS OF HEAT AND COLD

Burns.—The burns of the head which the surgeon is called upon to treat are not usually very deep. The scalp is protected by hair, and if flames or steam rise into the face sufficiently to burn deeply, they will usually be inhaled and produce fatal internal injury. Most of the deeper burns of the face are, therefore, the result of a gas explosion or the electric flash caused by short circuiting. The importance of avoiding a scar is, of course, very great, so that slight burns should be carefully attended to.

Burns have been variously classified according to the depth to which the tissue is destroyed. For practical purposes, they may all be placed in three classes.

Burns of the First Degree.—The symptoms are swelling, redness, and tenderness of the skin. There is no visible destruction even of the epidermis, although this usually peels off in strips a few days later. A familiar example is a mild sunburn. There is increased redness of the burned area for a week or more, but no permanent scar.

Treatment of Burns of the First Degree.—The chief indication for treatment is the relief from pain. This is best accomplished by smearing the surface with one of the lighter ointments which contains a considerable amount of water, such as rose water ointment, or one of the ointments sold under the names of Lettuce Cream, Cucumber Cream, etc. Cow's cream is excellent for the purpose. Recovery promptly follows the application of any non-irritating substance.

Burns of the Second Degree.—Much of the epidermis within the burned area is destroyed. There are blisters either full of serum or collapsed, or the injured epidermis may have been more or less removed. Hairs within the burned area are also

burned away. There is redness, swelling, and tende
more or less free oozing of serum, and possibly of
Repair in this class of burns takes longer than in burn
degree, but no slough of the true skin occurs. If the
ness of the epidermal layer is here and there destroyed
are very small and are rapidly covered by spreading o
layer of epithelial cells. There is, therefore, no per
Redness will persist longer than in burns of the first
sibly for a month or more.

Treatment of Burns of the Second Degree.
indication for treatment is the relief of pain. Th
result is certain to be good. There are four plans o
One is to apply a dressing soaked with oil or spread w
in order to protect the injured surface from the a
changes in temperature. A second plan is to cover t
strips of rubber tissue or with gauze wet with norma
tion. The third plan is to treat the burned area with
dressing, which may be allowed to dry or which may b
The fourth plan is to leave the burned area exposed
order that it may dry up.. Various dusting powders
to further this last plan.

The author favors the first or the second of thes
believing that these dressings are more comfortable t
and that they favor the vitality of those portions of t
have been injured but not destroyed by the burn;
such dressings, provided plenty of ointment is used,
water if a wet dressing is employed, can be removed
and damage than other dressings which are allowe
Powders are objectionable, since they form, with t
rum, hard crusts which are veritable culture tubes
It is impossible to make or keep aseptic an area o
has been burned below the superficial portion of t
Protection against infection depends, therefore, on t
the remaining skin rather than on the antiseptic qu
dressing. Hence, the latter should be soothing to th
than deadly to the bacteria.

A good example of an oily dressing is carron oil,
equal parts of linseed oil and lime water. If thi
gauze should be thoroughly saturated with it, as oth

will soak into the outer dry dressings, and the inner layers will become very firmly attached to the skin. For this reason an ointment is preferable in most cases. A good one is composed of one dram of boric acid to the ounce of vaseline. The ointment should be sterilized by setting the jar which contains it in a pan of boiling water. It can, of course, be sterilized in a steam sterilizer. The ointment should be used freely. A good plan is to spread it over the burned area with a spatula, much as one spreads butter with a knife. Dry gauze can then be applied in pieces small enough to fit the part, and the dressing fixed by a loose gauze bandage.

The principle of the normal saline solution when used as a dressing for a burn is the same as when used as a dressing for a skin graft. It is to reproduce as far as possible the normal surroundings of growing epithelium. If this plan is adopted, the burned area should be immersed in a saline solution, or lightly sponged with swabs saturated with the same. It is then covered with several thicknesses of gauze saturated with saline, and evaporation is prevented by covering the whole with a sheet of gutta-percha tissue, or strips of gutta-percha tissue may be applied directly to the burned surface, and these in turn be covered by the wet gauze. When the dressing is applied in this manner, a sheet of impervious material may be applied externally, or this may be omitted and the gauze kept wet by more frequent saturation with saline or boiled water.

Picric acid is recommended by those who favor antiseptics in the treatment of burns of the second degree. Gauze is saturated with a one per cent solution, either before or after it is applied to the burned surface. This dressing is supposed to control the pain, but I have seen patients suffer severely after its employment. It has a tendency to dry up the exudate, so that in many cases burns treated in this way are greatly improved in appearance. The intense yellow color of the picric acid stains the clothing.

A mild antiseptic solution suitable for use in burns of the second as well as of the third degree, is a four per cent solution of aluminum acetate. The gauze should be saturated with it, and then kept wet by the addition of sterile water from time to time.

If it is decided to treat the burn by the dry method, it may be left exposed to the air or cleansed and dusted with a powder, such as bismuth subnitrate, or bismuth subgallate, or nosophen.

Burns of the Third Degree.—Portions of the
possibly still deeper structures have been destroyed by
is easy to be misled in this matter by the early appea
skin. In a burn of the first or second degree the aff
red from the congestion of the vessels in it. If the v
corium is destroyed, the blood cannot circulate throug
and the skin will therefore appear white. The differ
this skin and normal skin is easily recognized if o
changes in color due to pressure made upon it. S
will, of course, be wanting in the dead skin. Furth
a white, dead area will invariably be surrounded by
zone in which the burn is only of the second degree.
several instances in which intelligent physicians overl
of the third degree, being misled by the lack of r
skin. This dead skin will, of course, slough, and
become entirely loose. During this process, which so
two weeks or more, there is danger that the slough
with the exit of underlying pus.

Treatment of Burns of the Third Degre
then, in burns of the third degree, three indications f
ment—the relief of pain, protection of the injured l
sues, and drainage of any pus pockets which may fo
antiseptic dressing best fulfils the requirements.
morphine should be given either hypodermically or b
ing the first twenty-four hours. Few persons can sle
opiate the first night after a burn, even if they ca
pain while awake.

The moist dressing should be applied warm an
The gauze may be saturated with aluminum acetate,
above, or boric acid, or any other feeble antiseptic.
should be kept constantly moist, and in some instan
ous bath is desirable.

Frequent dressings are to be avoided, but if the
come saturated with pus and serum, the comfort of
usually promoted by changing them. Sloughs shoul
as soon as they loosen, but not before. If a large a
the central portions of the skin may loosen before
so, incisions should be made through the slough or
excised to permit free escape of pus and secretions.

The repair after a burn of the first or second degree is accomplished by the normal growth of the epidermis. In every burn of the third degree the removal of the sloughs is accomplished by the growth of granulations beneath them. These granulating areas must be covered by the lateral growth of the epithelial cells, either from the edge of uninjured skin, or from islands of epithelium which have been left, or from the epithelium which lines the fat and sweat glands. This new epithelium at first has no color of its own, and simply looks like a dark red glaze over parts of the granulating surface. Later, as the epithelial cells multiply, a whitish appearance results. It will be evident, therefore, in two or three weeks whether the burned area will become covered with epithelium within a reasonable time. An epithelial edge will grow about an eighth of an inch a week. A granulating area, therefore, which is an inch in its smallest diameter, will require a month for its complete repair. Areas larger than this, and which are without epithelial islands should be skin-grafted (see Chapter XX).

There is one other thing to be borne in mind during the repair, and that is the possibility of cicatricial contraction. This can be avoided to a certain extent by the judicious use of plaster bandages and splints to keep the burned area fully extended during the healing process; but a far better means of prevention is the early covering of the granulating surface with pedicled flaps, or when this is not practical, with Thiersch, or better, with Wolfe grafts. In this way the amount of scar tissue is kept at a minimum and the power of contraction will be slight.

Sunburn.—This injury, though not serious, should be prevented many times when it is not. Before exposure to the rays of the sun the skin should be rubbed with cold cream or some simple ointment, such as boracic acid ointment, and when the skin shows the first pink color, it should be covered with clothing. If one waits until the sensation of burning is present, the mischief will have been accomplished. The treatment of sunburn is that of a burn of the first degree. Washing with soap is to be avoided.

Sunburn of the lip is very annoying because it takes from one to two weeks for recovery. This is because the thinner epithelium in the burned area is totally destroyed, and the little ulcer which results must heal entirely by growth of epithelium from its edges, at the rate of one-eighth of an inch per week.

X-Ray Burn.—Exposure to the X-ray in some cas minutes only, produces a redness of the skin which s sembles sunburn. It does not, however, appear until after the exposure. If the exposure is frequently ulcer may form.

The milder lesions quickly disappear, and requi treatment than soothing applications. The ulcers ar painful. Ointments containing cocain, morphine, orthoform should be tried. Stelwagon recommends c skin-grafting in obstinate cases.

Frostbite.—The ears, cheeks, and nose are the head most often frozen. If the part is still froz patient is first seen, it should be rubbed lightly until the circulation is reestablished, in order to av reaction.

Frostbite of the head requiring surgical treatm always confined to the ears. The symptoms of cyan pain, and tenderness are here well marked. Occasic form; but gangrene is uncommon, at least in this lat

Various applications have been recommended The good effect of treatment seems to be due merel tenance of an even temperature which facilitates the to the part. Moreover, the dressing protects the ear changes in temperature. Any astringent, or a sim such as one containing tannic acid or ichthyol, spr layer upon gauze applied to the ear and covered w cotton, forms a satisfactory dressing.

If a portion of the ear is gangrenous, it should n until a line of demarcation is well established. It seen that gangrene does not extend deeper than th sibly the epidermis. (Compare gangrene of the ex frostbite, Chapters XV and XVIII.)

Dermatitis.—Sunburn and frost-bite are form due to heat and cold. Dermatitis may also be due the treatment for which is essentially the same as sunburn. In other cases, dermatitis follows the drugs externally or internally, while a very commo matitis is due to contact with poison ivy. These h name of dermatitis venenata if due to an external due to an ingested drug or poison, the name dermatitis medicamentosa is used.

Iodoform, mercury, carbolic acid, cantharides, dyestuffs, etc., will poison certain skins. There may be simply a redness and burning, or there may be a profuse eruption of vesicles. In ivy poisoning these vesicles are of various sizes, and a number of small ones often merge.

In most cases of dermatitis, as soon as the cause is removed there is a prompt recovery. Treatment consists, therefore, of soothing applications, such as a two per cent solution of boracic acid, or the application of a simple ointment. Larger vesicles should be punctured and their contents expressed. In some cases an opiate is required. If the eruption is due to the ingestion of a drug, the drug should, of course, be stopped and a diuretic and cathartic should be given.

ACUTE INFLAMMATIONS

There are four common skin lesions of an inflammatory nature frequently found upon the face, with the diagnosis and treatment of which every physician should be familiar. They are urticaria, herpes, impetigo, and acne. A brief description of these four diseases is given here because of their acute character, as well as to differentiate them from forms of inflammation in the skin generally considered surgical.

Urticaria.—Urticaria is a form of eruption greatly resembling the bites of insects. Indeed these bites are classed as lesions of urticaria by some writers. Other external irritants, and various articles of food, especially shellfish, pork products, and strawberries, will produce urticaria in some persons. The lesions come up quickly and usually subside in a few hours.

A saline cathartic should be given, or under certain circumstances an emetic. The affected skin should be bathed with a lotion, usually containing one or two per cent of carbolic acid, to relieve the itching. Three ounces of alcohol, three ounces of camphor water, and one dram of carbolic acid, make a good lotion for the purpose.

Herpes.—The lesion of simple herpes, or fever sore, is a group of half a dozen vesicles, each of which is about as large as a pin-head. These contain at first serum, but later th become purulent. By drying, a crust results which fa out leaving a permanent scar. The lesions are us either upon the face or the genitals. They are often lips in the beginning of acute disease, especially acut tions of the respiratory tract.

Any one group of vesicles lasts only a few da vesicles may form in the vicinity. A good plan is affected skin every two or three hours with spirits or with tincture of benzoin. Carbolic salve may b the surrounding skin in the hopes of preventing from forming. When a crust has formed, cold cr applied.

Impetigo.—Impetigo contagiosa is an acute co ease, the lesions of which are usually found upon th is first noticed a number of vesicles which soon become which may coalesce. Crusts form, dry up, and fall o permanent scar because the lesion is, in most instan to the more superficial portion of the skin. For the there is little induration about any pustule. Succe vesicles appear, especially if the patient breaks the f or pustules by scratching.

The essentials of treatment are cleanliness a Blisters should be punctured, crusts removed, and lotion or ointment applied. A good preparation is which ammoniated mercury has been added in the fifteen grains to the ounce, or twenty grains of s ounce. The sound skin in the neighborhood shoul with an antiseptic solution. A good one for the pu under Urticaria.

Acne.—Acne is defined as an inflammatory sebaceous glands of the face, chest, and shoulders. tressing to the patient when it appears upon the fa ally chronic. A careful examination of the skin w affected will show that many ducts of the sebace blocked up, and contain sebaceous material mixed w the common name "blackhead." Other obstructed centers of little red, inflamed papules. Pustules around others, while there are numerous scars of which have healed. Many of these lesions run their life history without sufficient suppuration to leave a permanent scar.

There are three factors in the development of acne—blocking up of the sebaceous duct, presence of micro-organisms, and a lowered power of resistance to these organisms on the part of the individual. Thus, digestive disturbances, the use of irritating drugs, menstrual irregularity, and other general causes exert a considerable influence. Acne is especially common between the ages of fifteen and twenty-five.

TREATMENT.—Both general and local treatment should be employed. Errors in diet should be corrected, out-of-door exercise encouraged, and such other measures instituted as will tend to improve the patient's general condition. Free action of the bowels should be secured. Tonics are helpful, but no drugs should be given which are likely to upset the stomach.

Local treatment is most important. The affected part should be washed every night with very hot water, and as strong a soap as the skin will tolerate. Tincture of green soap acts well in many cases. The soap should be thoroughly removed by hot water, the skin dried, and a stimulating antiseptic ointment rubbed into it. In the morning this ointment should be washed away with soap and warm water, the skin dried, and a soothing ointment rubbed into it. Cold cream answers the purpose very well. Only a small quantity should be used, and any excess wiped away with a soft cloth. A good stimulating ointment is benzoated lard to which has been added precipitated sulphur in the strength of one or two drams to the ounce. Instead of the ointment a stimulating lotion may be employed, such as one composed of four drams of precipitated sulphur, two drams of alcohol, thirty minims of glycerin, and four ounces of water. The strength of the application used must be varied to suit different skins, and it is often of advantage to change the formula employed from time to time. There are many of these given in every book on dermatology.

Individual acne pustules should be stabbed with a fine lancet or a three sided, straight glover's needle, and their contents gently expressed.

Acne hypertrophica is described with new growths on page 83.

Cellulitis.—Cellulitis of the head, whether it affects the hairy or smooth skin, presents the usual characteristics: namely, edema, heat and redness, and, especially if pus is present, there will be pain on pressure. The scratch or slight wound through which the infection entered can usually be found. Often it is covered with a crust, beneath which will be found a drop or two of pus. Two questions are of importance. Is the cellulitis due to erysipelas? Is there a hidden focus of pus? The distinguishing marks of erysipelas are given below. The presence of pus may usually be known by a greater tension of the swollen skin, and the pain which pressure causes at this point. If there is an abundance of pus fluctuation is a valuable sign, but it is unobtainable at an early stage. Note the enlargement of regional lymph glands. They may suppurate also in some cases.

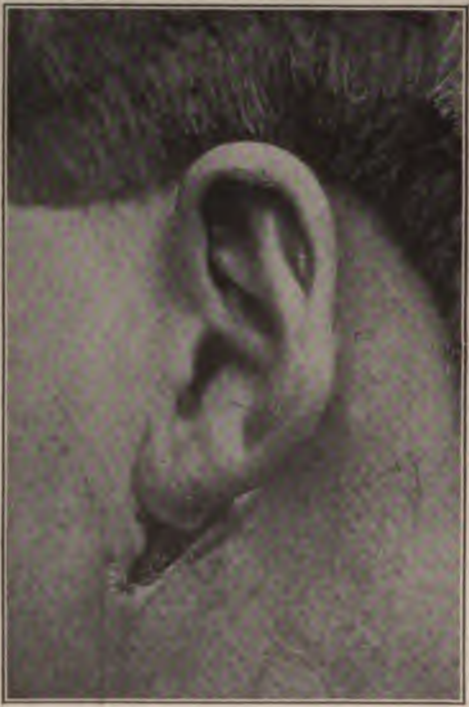

FIG. 9.—NECROSIS AND SLOUGH OF SKIN DUE TO CELLULITIS.

TREATMENT.—If the diagnosis is doubtful, or if pus has been found and evacuated, a moist antiseptic dressing should be applied and kept wet. No gutta-percha tissue, nor other impervious material should be applied in such a manner that evaporation is prevented. Any mild antiseptic solution may be used, such as aluminum acetate, four per cent; bichlorid of mercury, 1:2,000; creolin, 1: 200, or one of the proprietary articles, such as borolyptol, 1: 4. The edge of the cellulitis should be marked with an indelible pencil or with nitrate of silver, and the temperature and pulse recorded every three hours. Examination on the following day will determine whether the case is a simple cellulitis, or erysipelas, or whether the symptoms are due to hidden pus.

The severe effect of a peculiarly localized cellulitis is shown in Figure 9. The inflammation showed no tendency to spread, and no pus was present, but there was a considerable necrosis of the skin resulting in the small ulcer shown in the photograph. Staphylococci were present in the tissues and the discharge.

Erysipelas.—The face is the most common seat of erysipelas. It usually begins on one side of the nose as a dark pink blush. The affected skin is slightly edematous, so that the margin of the affected area is raised. This edge spreads at an appreciable rate, an inch or more a day, though not equally fast in all directions. There is often pain in the affected part, and the constitutional symptoms are out of proportion to the extent of the skin involved. There is usually an initial chill, and the temperature is commonly above 102° every afternoon as long as the inflammation is spreading in the skin. The infection enters the skin through some scratch or cut, which can usually be found if looked for. In the case of facial erysipelas this break in the skin is usually to be found inside of the nose. The patient will often remember to have forcibly removed some crust from the nose a day or two days previous to the attack.

TREATMENT.—Compresses wrung out of a five per cent solution of carbolic acid in equal parts of alcohol and camphor water will be found agreeable to the patient, and may assist in limiting the spread of the inflammation. The more radical method of employing carbolic acid is to paint the skin immediately in advance of the inflammation with the liquid carbolic acid, ninety-five per cent. If the skin is at once wiped off with pure alcohol no injurious caustic action of the acid will result. In this way extension of the erysipelas may sometimes be cut short; but those who have the opportunity of treating a large number of cases of erysipelas usually doubt the curative power of any application whatever.

If abscesses form, they should be incised. The general condition of the patient should be watched. Laxatives, light or fluid diet, and possibly stimulants, are the essentials of treatment. As erysipelas is conveyed from one patient to another by contact, the surgeon should, if possible, avoid touching the patient or his clothes, and should wash and disinfect his hands at the close of his visit. Similar precautions should be observed by the nurse or attendant. It is a good plan, if the patient is not too ill, to let him make the applications himself, thereby lessening the risk of in one else.

Boil, or Furuncle.—The face is a common se which do not, however, reach a large size, for the rea skin is thin and is well supplied with blood. Every be made to cut short the infective process, because th conspicuous, and also to avoid the disfigurement of scar.

The diagnosis is simple. The swelling, redness, ness early attract the patient's attention. The only decided is whether or not pus has collected in sufficie make its evacuation desirable. If it shows as a yello center of the swelling, the patient will usually perm tion; and yet the necessity for this is sometimes far the pus does not lie so near the surface. The presenc tense, and well localized swelling in or beneath the indicates a collection of pus under these circumstanc

TREATMENT.—The best treatment is prompt inci the escape of pus and necrotic material. Specific opening boils and abscesses are given in Chapter X incision will often suffice for these small boils of the pare the treatment of acne pustules, page 33.) One the temptation to squeeze pus out of the tissues afte has been made, as infection is often spread in thi very short incision, say not more than a quarter length, which should usually be crucial or T-shaped rapid reattachment of the cut surfaces, is long eno boils of the face at an early stage.

In most cases a minute drain, consisting of a or a narrow strip of gutta-percha tissue, should be wound for twenty-four or forty-eight hours. A wet d favors recovery. If it is necessary for the patient may cover the wound with a bit of gauze and a p plaster, removing this once or twice a day in ord parts with hot water, and at night a large wet d be applied.

In some cases the application of ninety-five pe acid directly into the center of the boil will stop t hasten the expulsion of the necrotic portion. In the boils, the acid may be applied upon a toothpick, even though no incision has been made.

The general condition of the patient should be investigated, and necessary advice given concerning diet and exercise. Laxatives are usually beneficial. A tablespoonful of brewer's yeast three times a day before meals is thought by many to have a specific action in recurrent cases. Sulphur and its compounds may also be given with benefit; for example, half a grain of sulphid of calcium twice a day.

Stye, or Hordeolum.—A small boil at the root of an eyelash is called a stye. If untreated, one of these minute abscesses requires several days for its full development. It often causes great pain. Pus then escapes at the edge of the lid, the pain is relieved, and in several days the swelling disappears. There is a strong tendency to recurrence of the trouble in some other portion of the lid, so that it is no uncommon thing for a person to suffer from a series of styes, one or more developing at the same time, the whole series lasting possibly several weeks.

Prophylactic treatment, which will also sometimes serve to abort a commencing suppuration, consists in the application of an ointment containing eight grains of the yellow oxid of mercury to the ounce of vaseline. It is also well to wipe the edges of the lids occasionally with a cotton swab wet with a 1: 2,000 solution of corrosive sublimate. A formed abscess should be punctured with a sharp, narrow lancet. If the blade is thin and very sharp this is not a very painful procedure, and no anesthetic is required. To relieve pain either before or after puncture, hot, moist compresses may be applied. Constipation should be corrected.

Boils of the Nose and Ear.—Small but very painful boils form in the skin or mucous membrane attached to the cartilage of the ear or nose. Because of the close attachment of these structures, the pain caused by the swelling is intense. An early incision is therefore demanded. Even the injection of a local anesthetic is very painful. Hence a strong solution, say a four per cent solution of cocain, should be employed, and only a minim should be injected at first. When this has taken effect, the injection of the amount necessary to benumb the area of incision should be completed. A moist dressing should be applied, or the part should be soaked with hot water every hour or so, in order to keep the cut

open until all the discharge has made its escape. A
tend to recur, the affected area should be wiped
with an antiseptic (creolin, one per cent; bichlorid
1:1,000).

Abscess.—Suppuration in the deeper tissues of
result of injuries and wounds, is usually prevented
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Absces
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Ab
scalp,
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to be
While the blood supply of the scalp itself is very
just beneath it a loose fascia with large spaces a
vessels—a favorable tissue for the multiplication o
they are introduced into it.

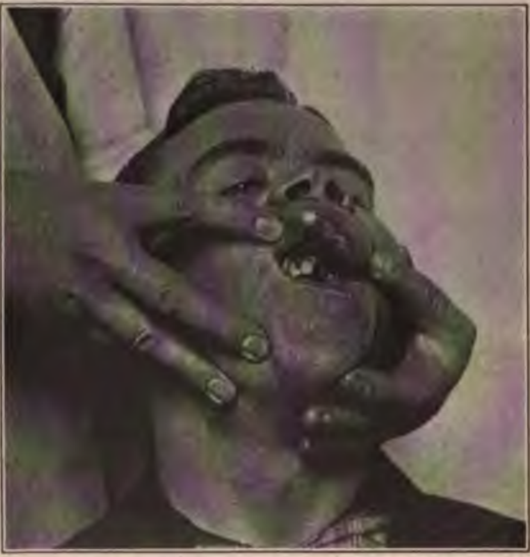

FIG. 10.—ABSCESS OF THE LIP. Infection due to a blow by which the lip was cut against the decayed incisor teeth. Photograph six days after the injury.

DIAGNOSIS.—These abscesses are not difficult o
The classic symptoms of heat, redness, tenderness, a
well marked. A small abscess in the tongue feels
kernel. An abscess of the lip or cheek causes a very
which may obscure the exact presence of the pus unti
by palpation. An abscess beneath the scalp yields a
of fluctuation.

TREATMENT.—The length of the evacuating i
be determined by the extent and nature of the a

acute, rapidly spreading, suppurative cellulitis, incision should be made to extend at least as far as the visible pus formation, whereas it is quite unnecessary to apply the same rule to the slowly forming abscess of a marasmic child. In the latter case a small opening, equal to one-half the diameter of the abscess, is sufficient to effect a cure, and thus hemorrhage is lessened and considerable time is saved in the healing of the wound.

The cavity of the abscess should be washed and wiped clean with saline solution or sterilized water and moist cotton swabs or dry sterilized gauze. It has been commonly recommended to break down any septa which may exist, but, unless these interfere with the thorough cleansing of the abscess, they should not be disturbed, as they almost invariably contain blood-vessels, and if broken down, hemorrhage follows and blood clots are added to the contents of the abscess cavity, and the nutrition of the overlying skin is interfered with. Many abscesses of a sluggish nature, if emptied and cleansed, will heal without further suppuration. Such a result is favored by the introduction of a granular gelatin containing formalin. This acts as a drain and contains enough formalin to retard suppuration. Or the wound may be kept open by slender strips of gutta-percha tissue or gauze, moistened with a weak antiseptic solution.

Alveolar Abscess.—A common and often severe abscess of the face has its origin, as its name indicates, about the root of a decayed or broken tooth. The first sign of its presence is almost invariably a toothache. This may be due to congestion merely, but a violent toothache indicates pus with far greater certainty than most dentists are ready to admit. The pain is at first referred to the affected tooth; but as the inflammation spreads the nerves leading to other teeth may be pressed upon, and the pain referred to those teeth. There are three confirmatory tests to determine the exact location of the suppuration. Inspection will show the greatest amount of swelling in the mucous membrane alongside of the tooth involved. Secondly, if the teeth are lightly tapped with a metal instrument, the patient can usually recognize which one is diseased. In the third place, palpation will usually reveal the point at which there is the greatest swelling, and this, at least in the early stages of the trouble, corresponds to the root of the affected tooth.

The pus first forms between the root of the affect the bone in which it is placed—that is to say, in the As the pus increases in amount some of it may worl the surface and escape into the mouth alongside of the

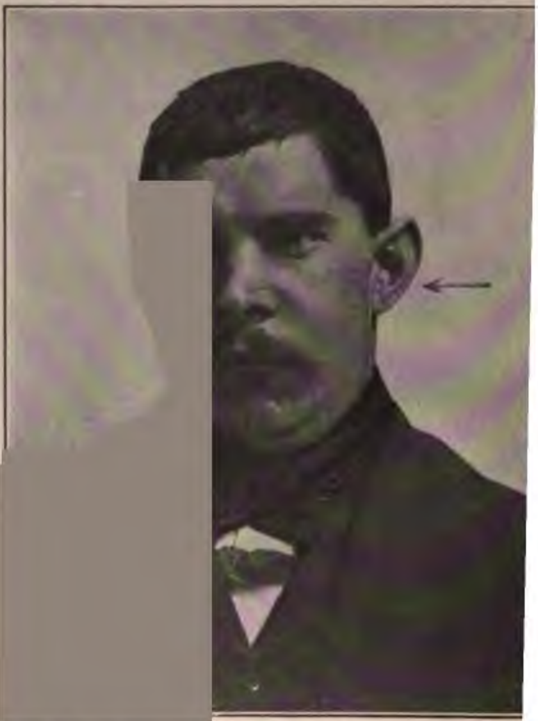

FIG. 11.—ALVEOLAR ABSCESS FROM UPPER INCISOR TOOTH. Note the swelling at the root of the nose. This is not a common type, a breaks into the mouth early.

will relieve most of the symptoms, and aside from ness, the only remaining ones may be a little swel escape of pus when the patient sucks the tooth or pre on the gum. In most cases, however, absorption tak the swelling extends beyond the gum immediatel affected tooth. This swelling will next be noticeabl and its situation will depend, of course, on the sit decayed tooth; thus, if an upper incisor is at fault will appear first at the base of the nose (Fig. 11). bicuspid or molar teeth are involved, the swelling further back in the cheek; whereas if one of the lower teeth is decayed, the swelling will be most marked just below it.

The infection may travel still further, and involve a lymphatic gland. This may be very misleading. The upper teeth drain into lymphatic glands situated at the angle of and below the lower jaw. If the regional swelling above mentioned is slight and the first prominent swelling is due to involvement of the lymphatic glands which drain the sockets of the upper teeth, the most marked swelling will then appear in the vicinity of the angle of the lower jaw. It is well to bear these facts in mind, lest finding a swelling near the angle of the lower jaw, one may falsely conclude that a lower tooth is at fault. This is what happened in the case of the boy shown in Figure 12, and a dentist extracted a sound lower tooth. The infective process continued, of course, until more intelligent treatment was instituted.

If an alveolar abscess starts from one of the lower teeth, the situation of the swelling is a more reliable guide to the source of the infection.

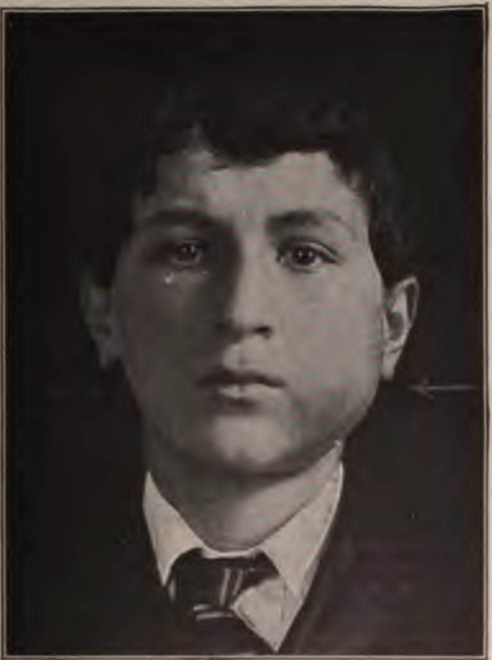

FIG. 12.—ALVEOLAR ABSCESS FROM UPPER MOLAR TEETH. Note the site of maximum swelling at level of the lobe of the ear.

COURSE OF THE INFECTION.—The pus at the root of the tooth may work its way out along the tooth and discharge into the mouth. Or, it may bore through the periosteum, and possibly a thin layer of bone, and discharge through the gum a little distance away from the juncture of the tooth and mucous membrane—say a quarter of an inch. This sinus is more often on the outer than on the inner side of the jaw. With the discharge of pus the acute

symptoms subside, but unless the tooth is filled or r
process may repeat itself.

The pus may strip the periosteum from the maxi
the periosteum, burrow between the mucous membra
skin, or rupture through the skin externally, either i
or beneath th
(Figs. 11, 1
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the process
can usually

The lymp
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Figure 13.

If an al
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cure. Such relief is often postponed until a portion
lary bone, deprived of its periosteum and bathed in
necrotic. The sequestrum thus formed will keep up
tion. If a patient is examined in this stage he will h
hard swelling, not easily indented by pressure wit
and which varies in size according to the drainage
through the existing sinus. The decayed tooth w
cause of the trouble may or may not be recognized
quently the patient has had it removed too late to st

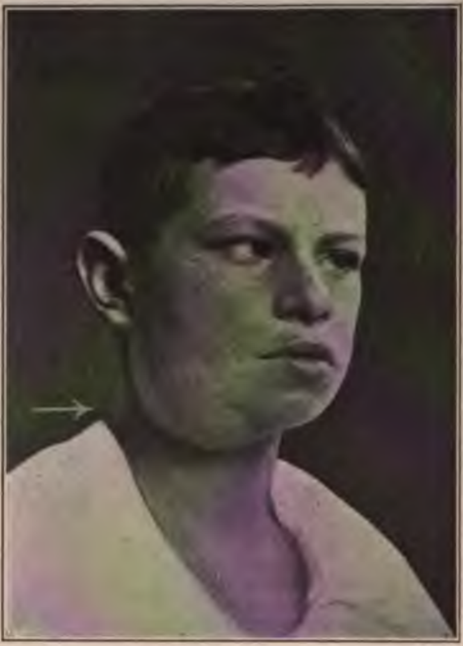

FIG. 13.—ALVEOLAR ABSCESS FROM UPPER TOOTH, SECONDARY IN LYMPHATIC GLANDS. The maximum swelling is beneath the lower jaw. This is also the site of swelling in cases of alveolar abscess of the lower teeth, without glandular involvement.

ration, as the bone has already become necrotic. In other cases several decayed teeth are present, but no longer sensitive, so that it may be difficult to decide which one has caused the trouble.

A probe passed into the sinus may or may not touch bare bone. The positive result of such examination is worth more diagnostically than a negative result. Furthermore, if bone is bare under such circumstances it is almost certainly dead. If necrotic bone exists the probe may fail to touch it because the sinus is tortuous. The sequestrum usually lies to the inner side of the lower jaw, and the sinus passes beneath the jaw and reaches the surface of the face on the outer side of the jaw. It is not surprising if so badly drained an abscess recurs from time to time. Such an experience was that of the patient shown in Figure 14.

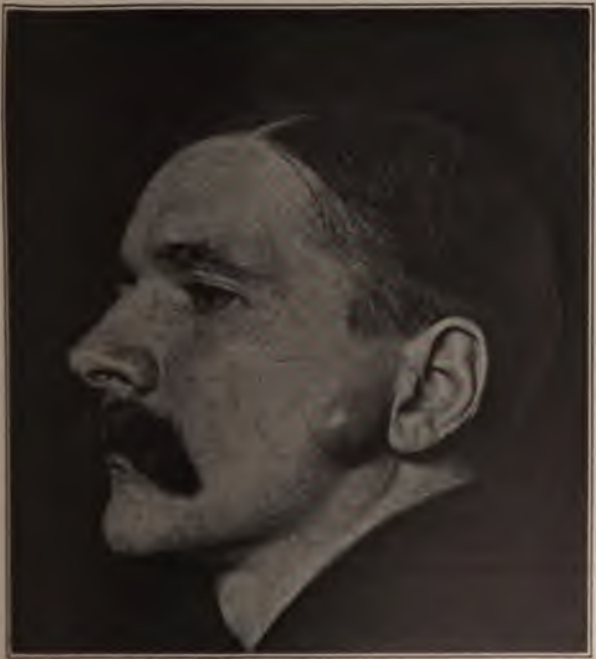

FIG. 14.—RECURRENT ALVEOLAR ABSCESS. Duration, twenty-five days.

If the sequestrum is a large one, two or more sinuses may exist. In such a case a part of the swelling which exists is due to the formation of new bone. The periosteum of the lower jaw is abundantly supplied with blood, and does not die easily. If it is stripped up from the old bone by the pus it imm gins to form new bone, so that in long standing cases of the sequestrum may be rendered difficult by the th new formed bone which surrounds it.

Another possible termination of an acute abscess is sinus. So long as this suffices to carry away the sligh it will prev formation scess. Usu ever, the obtained in ner is i swelling c tions block edema rea if the sinu opened anc forms. S giving imp age existed nese patie Figure 15 sistent dis indication ence of d a decayed tooth.

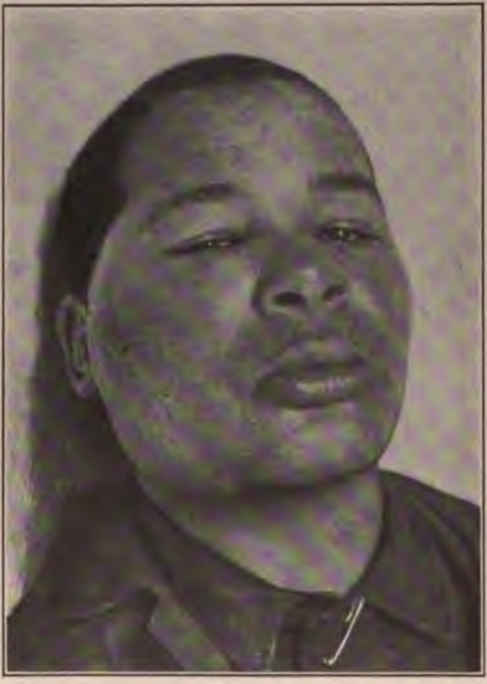

FIG. 15.—CHRONIC ALVEOLAR ABSCESS FROM DECAYED TOOTH, OF SEVEN MONTHS' DURATION. The abscess was lanced, but a sinus persisted.

A con ing is usu cation of root of the tooth or of the adjacent bone; there a in which, although no sequestrum can be made out escapes externally, the irritation about the roots of tooth is sufficient to form a chronic swelling. Possi case there may be a little suppuration which constan escape into the mouth. Figure 16 shows a patient wl tory of continued hard swelling long after the active had ceased. As long as such a patient retains the ro cayed tooth he is exposed to a recurrence of the acute

Finally, alveolar abscess may lead to the development of a malignant growth, as shown in Figure 17.

Treatment.—Treatment at any stage of an alveolar abscess, to be considered intelligent, must be directed toward removal of the cause. If a toothache is due simply to congestion, a local irritant, such as oil of cloves, chloroform, etc., with or without the internal administration of morphine or some other anodyne, may be considered appropriate treatment. If, however, the toothache is due to an inflammation about the root of a tooth, it must be looked upon as a real infection, similar, for example, to a cellulitis preceding from an unclean sliver in the finger. The site of the infection should be thoroughly exposed and drained so that absorption of the poisonous material may cease. The source of the infection is invariably found in the decay of a tooth or the root of a tooth previously extracted. Such a tooth should be treated or extracted without delay, no matter in what stage the infection may be. If the tooth is considered by the dentist to be worth saving, its cavity should be cleaned and disinfected so that further absorption shall not take place. The filling of such a tooth may be postponed until the acute symptoms have subsided. If a tooth is too far gone to be saved, it should be immediately extracted. Many dentists object to the removal of a tooth if an abscess is present, and advise the patient

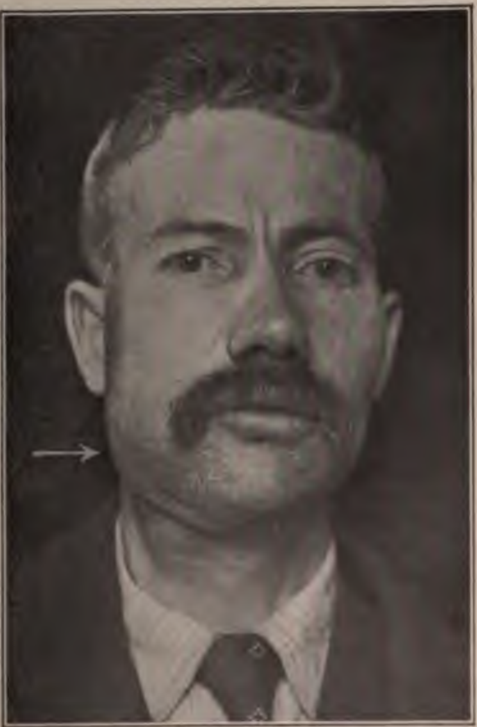

Fig. 16.—Alveolar Abscess from Decayed Lower Teeth; lanced inside and outside six weeks previously. Roots of teeth not removed. Swelling due to fibrous induration. No sinus and no pus, as far as can be made out.

to wait until the abscess has been cured. This is bad advice. It would be just as logical to wait for a cellulitis of an arm to subside before extracting the splinter in the hand which caused it. In a great many instances the extraction of a decayed tooth or of an old root will give the pus formed about its deeper portions a free opportunity to escape into the mouth, so that the abscess drained in this manner will rapidly subside in a few hours. Even if suppuration has extended so far from the tooth that the extraction of the latter will not afford sufficient drainage, it should still be insisted upon, as removal of the source of trouble will hasten the recovery, will relieve the patient at once of a considerable amount of pain, and will prevent also the recurrence of the abscess and the other complications spoken of above.

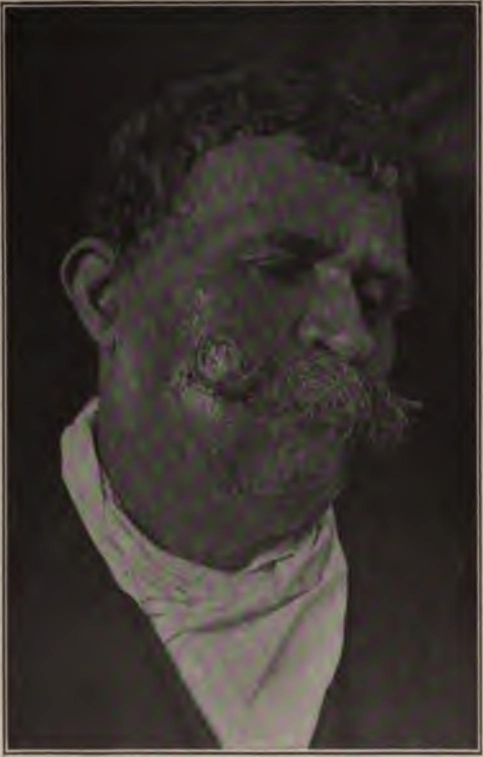

FIG. 17.—TUMOR FOLLOWING ALVEOLAR ABSCESS, THOUGHT TO BE SARCOMA. Tooth ulcerated three and one-half months previously.

If further drainage is necessary, as it is in every advanced case of alveolar abscess, the incision should be made through the gum rather than through the cheek. In suppuration of the lower jaw the drainage through the mouth is an attempt to cause pus to flow up hill, but it will in many cases succeed if the incision through the gum is a wide one and the abscess cavity is syringed out once or twice daily with diluted peroxid of hydrogen and kept open by antiseptic gauze. A day or two will prove whether or not this attempt will be successful. If not, an external incision should also be made. This need not be a very long one, since the internal incision should still be kept open, and will provide for the escape of most of the pus. An external incision is to be avoided, not only on account of the annoyance to the patient of a bandage around the head, but because the resulting scar is sometimes attached to the jaw bone, and thus forms a prominent dimple. This need not be a permanent disfigurement, however, for such a dimple may be removed by excision of the scar, dissection of the skin for a half inch in every direction, and suture of the skin. It is better not to perform this plastic operation till some months have passed, lest viable germs in the tissues may be roused into activity, and suppuration defeat the end of the operation.

A sequestrum of the jaw, due to delayed drainage, will usually loosen in a few weeks, so that it may be extracted through an enlarged sinus, either within the mouth or externally. Sometimes it is necessary to chisel away some newly formed bone to make a larger exit. In most cases, if a general anesthetic is given, so that the surgeon does not feel the need of haste, he can twist the sequestrum back and forth, and perhaps break off some portions of it, until it can be withdrawn without chiseling away any living bone.

INFLAMMATIONS OF THE EYE

There are some inflammations of the conjunctiva which will be here discussed because of their frequency and importance, and because they are amenable to local treatment.

Acute Conjunctivitis, or Simple Catarrh.—Acute inflammation of the conjunctiva may be divided, for practical purposes, into the cases which are due to the gonococcus, and into those which are not thus caused. The latter cases are sometimes called simple or catarrhal or muco-purulent conjunctivitis.

The usual signs of a mild catarrh are present. The secretion is increased, the blood-vessels are injected, there is a little swelling of the conjunctiva. There is a sense of heat and heaviness in the eye. In cases which develop spontaneously both eyes are affected at the same time or one soon after the other.

A number of micro-organisms have been isolated from eyes in such a mild state of inflammation, and it has been demonstrated that catarrhal conjunctivitis may occur in ep One eye may be involved alone as the result of traun

The inflammation in catarrhal conjunctivitis may small ulcers are formed, but this is the exception rat rule, and the outcome is complete recovery in almost

TREATMENT.—It is well to remember that most tarrhal conjunctivitis are distinctly contagious, and may be transferred from one eye to the other, or fro to another. Anything, therefore, which comes in con affected eye should be immediately sterilized or destr

In serious cases the patient should be kept in a da several pads of gauze, four or five layers thick, shoul a lump of ice by the bedside and placed by the pati closed eye. Every few minutes, as they become warm be changed. Several times a day the eye should be i a three per cent solution of boracic acid. When th less intense, an application of a twenty per cent soluti or a one per cent solution of nitrate of silver, shou by the surgeon to the everted lids, and almost imm tralized by a saline solution. Or the patient may be tion of sulphate of zinc, two grains to the ounce, a which he should instill into the affected eye once c The edges of the lids should be smeared at night ointment, so that they may not adhere and prevent secretion.

Purulent Conjunctivitis.—Infection of th with the gonococcus is a serious affection, since it extensive corneal ulcers, which may perforate and to prolapse, and which in any event are likely to hea

The disease occurs generally in new born infant If the child's eyes are infected during birth, the in pears from the second to the sixth day. If it app this, it is due to postnatal infection. In both inf the inflammation is due to contamination of the eye or some object which has been in contact with a dis ing gonococci.

In the first day or two the patient notices pai and eyeballs, and sensitiveness to light. There swelling of the lymph glands in front of the ears.

charge from the eyes becomes purulent, and the swelling of the lids is so great that they overlap or are everted. Ulcers of the cornea develop. The disease lasts in moderate cases from four to six weeks.

Treatment.—Prophylactic treatment is most important for infants and for adults as well. The eyes of every child after birth should be carefully washed with sterile water or boracic acid solution, and if there is the slightest possibility of contagion from the mother, a few drops of a one per cent solution of nitrate of silver should be instilled into each eye. Most cases in adults are due to autoinfection, and therefore every physician caring for a patient with gonorrhea should explain to him the risk of infecting his eyes, and give him directions in regard to the use of towels, cleanliness of his hands, etc.

The patient with purulent conjunctivitis should remain in bed in a darkened room. Ice compresses should be kept on the eyes at least one-half of the time, and the eyes should be frequently irrigated with a solution of permanganate of potash (1: 10,000). The free use of small doses of calomel will do much to decrease the swelling and lessen the risk of corneal ulcers. The edges of the lids should be smeared with boric acid ointment to prevent their adhering. After the first few days a three or four per cent solution of nitrate of silver may be applied by the surgeon to the everted lids and neutralized with a saline solution. This treatment may be repeated once a day, or once every second day. The patient should be careful not to infect the sound eye, and should sleep with this eye uppermost, so that no secretion may trickle into it. At the first sign of redness, the sound eye should be treated with a two per cent solution of nitrate of silver.

Stye.—(See p. 37.)

Granular Lids or Granular Conjunctivitis.—Repeated irritation of the eye will often result in an injection of the blood-vessels of the eyelids, and a dry and rough, almost sandy feeling. Badly nourished individuals, such as anemic children and overfed adults with a uric acid diathesis, are especially liable to this condition. In many persons it is brought about in a mild degree by the excessive use of the eyes, or by the lack of suitable glasses, or by exposure to wind or dust.

An inspection of the lids, and especially the upper one, will

show that the normal smooth pinkish lining present
appearance, due to the injection of the blood-vessels,
oblique illumination the surface is irregular, sugges
lations.

In mild cases the removal of the cause and the insti
the eye of a few drops of concentrated boric acid sol
daily will speedily effect a cure. If lithiasis exists, m
ents should be given with several glasses of water daily
to the local treatment. If these simple measures fa
junctiva of the lids should be wiped occasionally wit
of copper sulphate.

Trachoma.—The disease is marked by the fo
whitish or pinkish bodies in the conjunctiva, especi
upper lid. It is generally considered to be contagio
it is much more common among anemic children, an
are crowded together in rather unhealthful surroundi

The affected eye, in addition to the granules above
usually shows the signs of catarrhal inflammation, an
stage there are dilated blood-vessels and the formatio
tissue over the cornea as well as over other portions
In this manner the vision may be completely lost.

TREATMENT.—One of the best methods of treat
application of a smooth crystal of sulphate of copp
fected conjunctiva. For fifteen minutes thereafter, co
cations should be made to the eye. In severer cases,
tions are scraped or cut away or squeezed out. For t
such treatment the reader is referred to special tex
the eye.

Any treatment to be successful must be continue
until the tendency to form new granulations has
overcome. As the presence of this disease keeps a
school, and for that reason, even without a permanen
of sight, seriously handicaps his future, those in cha
institutions containing children should spare no pai
this disease and to eradicate it when it occurs.

Ingrowing Lashes or Trichiasis.—It somet
that the eyelashes, instead of growing in the nor
curve inward and thus become a constant source o
the eyeball. This is one of the complications of gra

tiritis. A wedge-shaped strip may be cut from the outer surface of the eyelid and the wound sutured. The wedge must, of course, include the whole thickness of the cartilage of the eyelid in order to secure a permanent eversion of the lashes. The lines of the incisions should be parallel to the edge of the lid, and the one nearest the edge should be distant from it an eighth of an inch, so as to avoid the roots of the eyelashes. For the details of this operation the reader is referred to text-books upon the eye. Single lashes may be extracted by means of smooth forceps—that is, forceps whose points are free from ridges or teeth, for the latter would be apt to break the hairs. This is naturally a purely palliative procedure, as the lash will soon grow in exactly as before; but the relief occasioned by it is immediate and so gratifying that the patient will gladly return month after month to have the offending hairs again extracted.

If only two or three hairs forming a single group are turned inward, the simplest method of cure is the removal of a small section of the edge of the lid containing these hairs, and the suture of the gap thus caused.

INFLAMMATION OF THE EAR

Otitis Media.—This is a common disease of childhood, usually following a cold in the head. The prominent symptom is earache. Every physician ought to be able to recognize the bulging outward of the membranum tympani and to relieve the pressure by incision of the membrane at the most favorable situation—viz., the inferior and posterior portion. The introduction of warm olive oil into the external meatus will sometimes relieve pain, and the application of external heat may also be tried; but the pain of a severe earache, unless relieved by puncture of the membrane, usually demands the internal administration of morphine. The membrane usually ruptures spontaneously in the course of a day or two. Pain is then relieved, and a muco-purulent discharge begins and continues for a time. After it ceases the membrane soon heals over. While the discharge continues, the treatment consists in cleanliness. The ear should be syringed gently once or twice a day with warm normal salt solution, and wiped dry with absorbent cotton.

Unfortunately, this simple termination is not the only one which is possible, for inflammation of the middle ear may extend to the mastoid cells, and result in abscess within the cavity of the mastoid bone. If prompt drainage is not instituted, the suppuration may extend into the lateral sinuses and to the membranes of the brain, causing the death of the patient. Hence the necessity of early recognition of the disease and prompt treatment before these serious complications have arisen.

The external ear should be cleansed by washing it with small cotton swabs wet with a warm antiseptic solution, and the membrane anesthetized by the instillation of a few drops of a ten per cent solution of cocain. An ear speculum should then be introduced, the membrane inspected by reflected light or a headlight, and incised in its lower and posterior portion by means of a long slender scalpel bent in the handle at an angle.

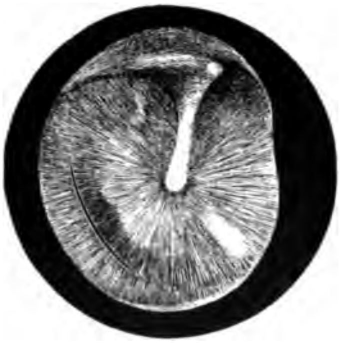

Fig. 18.—Sketch of the Normal Right Tympanic Membrane. Showing the correct site for incision.

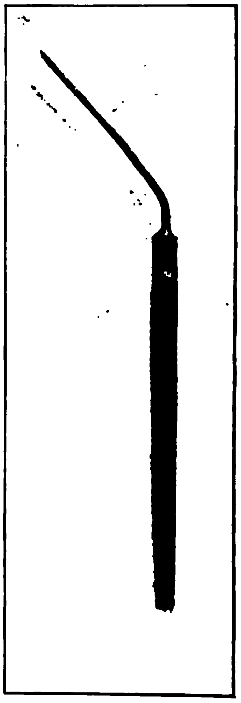

Fig. 19.—Angular Knife for Incision of the Tympanic Membrane.

Figure 18 shows the normal membrane, and the correct size of an incision, which should be of sufficient length to permit the escape of the pus and mucus. Figure 19 shows a good knife for making the incision.

When the incision has been made through the bulging membrane, a few drops of pus and mucus and often a little blood will escape. Irrigation is not necessary, but the auditory canal should be sponged clean with cotton-tipped probes dipped in a warm antiseptic solution. In the case of a nervous or restless child, it is best to perform this operation in general anesthesia. The incision can then be more accurately made.

The after treatment consists in cleanliness. The canal should be wiped or washed clean, and the inner ear protected from temperature changes by a small cone of dry absorbent cotton introduced after each cleansing and as often as the previous cone becomes moist.

Boils.—A description of boils of the external auditory meatus is given on page 37.

INFLAMMATIONS OF THE NOSE

Acute rhinitis may be accompanied by a troublesome herpes of the lower portion of the anterior nares and the upper lip. The application of menthol in albolene (gr. x–℥j) gives some relief. The surrounding skin should be smeared with carbolic salve to prevent the spread of the process.

Chronic Rhinitis.—The usual outcome of chronic rhinitis is hypertrophy or atrophy of the mucous membrane of the nasal passages.

Hypertrophy of the inferior turbinate bone in many cases is best cured by removal of the major portion of this bone. This is a minor surgical operation, and one whose technical difficulties are not great, but the decision as to the necessity for its performance and as to the manner of its removal demands a thorough knowledge of the pathology of the nose, which the reader will find fully given in books upon that special topic.

There are, however, two complications of rhinitis which may require immediate treatment, and which are therefore here described.

Suppuration in the Frontal Sinuses.—In many cases of influenza and other forms of rhinitis the inflammation and swelling of the mucous membrane extends to the accessory sinuses of the nose, the most important of which are the frontal sinuses and the antrum of Highmore. Such extension prolongs the attack and increases the discharge, but usually subsides in a few addition to the general symptoms of infection there pain and tenderness throughout the area occupied by so that the diagnosis is not difficult to make if its p borne in mind.

In certain cases the inflammation becomes purule acter. Even then the patient is ordinarily relieved by of pus and mucus through the natural opening. Shou not afforded in this manner, the sinus may be drain the nose after removal of the middle turbinate. Th special technic. If the symptoms are severe, and e there is reason to feel that extension to the brain is an incision should be made through the eyebrow an drained directly by chiseling through the bone, eith below the margin of the orbit. This operation is ext ple, if one has at hand a small sharp chisel, and in c it saves a person's life. The wound should be drain suppuration ceases. There is only a slight permanent

Suppuration in the Antrum of Highmore. puration in the frontal sinus, this follows acute coryza also be secondary to diseases of the teeth, especially o tooth.

The symptoms are pain and fulness in the roof o usually with intermittent discharge of pus from the temporarily relieves the symptoms.

Transillumination is a valuable means of diagnos electric lamp held in the closed mouth shines through side with much less power than through the normal

TREATMENT.—A large, curved trocar and canul passed through the septum between the antrum and meatus of the nose. Through this canula the pus ca out. This washing should be repeated daily with w solution. A smaller canula should be employed for th treatment, so that it can be passed through the openi without difficulty.

More direct drainage is obtained by chiseling of the anterior wall of the antrum through an inci the reflexion of the mucous membrane from the upp cheek. This incision should extend from the canin first molar. If the canine or one of the bicuspid teeth is already diseased, the opening may be made through its socket. The sinus should be irrigated daily for a week or two until the suppuration subsides.

Boils.—(See p. 36.)

INFLAMMATIONS OF THE MOUTH AND THROAT

Stomatitis and Gingivitis.—The occurrence of these low degrees of inflammation in the mouth usually indicates a low degree of vitality, or in certain cases that the vitality has been reduced by poisons—for example, mercury.

Treatment.—The general condition should be improved by changes in diet and tonics. If there is a local cause for the trouble, such as decayed or neglected teeth, this should be attended to. The patient should be given a stimulating mouth wash, such as a solution of permanganate of potash, one grain to the ounce; or a mixture of tincture of myrrh, one part in twenty of water. The inflamed gums may be painted with the tincture of myrrh.

Such inflammations, even when severe, rarely lead to suppuration, and require no operative treatment.

Alveolar Abscess.—(See p. 39.)

Peritonsillar Abscess.—Certain cases of acute tonsilitis are followed by the formation of an abscess, either within the tonsil or, as is more common, in the tissues around it. In the latter case the most common situation is above the tonsil.

It is of importance to recognize early the collection of pus, either within or outside of the tonsil, since its early evacuation before a large abscess cavity has formed greatly shortens the course of the disease. Sometimes the patient first recognizes the extension of the swelling outside of the tonsil. Inspection will show the mucous membrane over the abscess to be of a dusky red hue, and the palpating finger will reveal an area of induration with fluctuation in its center. Under such circumstances an incision should be promptly made. Nothing but pain is gained by delay.

Treatment.—As soon as the abscess is recognized it should be evacuated through a suitable incision. The mucous membrane is readily cocainized by the application to it for five minutes of a swab wet with a ten per cent solution of cocain. If there is any doubt as to the situation of the pus, aspiration shoul formed. A hypodermic syringe is sufficiently large foı pose, provided a needle of good size be employed. Th should be made in the center of the abscess, the stroke b without inward in order to avoid wounding any de When the abscess cavity has been opened, the incisioı enlarged with knife or scissors in whatever direction wil best drainage. If a drain is to be employed, it is a goo cut out a small triangular portion of the mucous meı insure an opening sufficiently large to permit the rein the gauze. It is a good plan to syringe the cavity once day with a mixture of one part of peroxid of hydroge of water.

Retropharyngeal Abscess.—Abscess between th wall of the pharynx and the cervical vertebræ is usual badly nourished children, and is secondary to infectiv in the nose or throat or ear in the large majority of c immediate symptoms of an abscess in this situation ar difficulty in swallowing and in breathing. The general of unrelieved suppuration, high pulse and temperature etc., are well marked.

The posterior wall of the pharynx bulges forward soft palate, and may often be felt to fluctuate when pa a further confirmation of the diagnosis, and as a guide sion, the boggy swelling should be aspirated with a nee size. Pus having been located, should be at once eva is exhausting to the patient to allow it to remain, a in this case the added danger that the abscess may r ing sleep, and the patient be drowned in the pus whicl his throat.

Treatment.—When the pus has been recognized, evacuated through an incision made in the median pharynx as low down as possible. A child should and pinned in a sheet so that his arms can be easil and a good mouth-gag placed in position. A few in chloroform do not materially add to the risk of op spare the feelings of patient, mother, and doctor. V tions for the patient have been recommended, all a the idea of giving the operator a good view of t venting the evacuated pus from flowing down into the larynx. A horizontal lateral position is perhaps as good as any. The finger should guide the knife, all but the point of which should be protected by wrapping it with adhesive plaster. The most prominent point in the swelling should be punctured, and the incision quickly enlarged either upward or downward, as the case may require. The knife is then withdrawn and the body of the child somewhat elevated and turned so that the pus may flow out of the mouth. The abscess cavity should be irrigated with saline solution, but not drained. By palpation the operator should convince himself that a sufficient opening has been made to assure free drainage. Hemorrhage may be controlled by a temporary packing of the wound with gauze.

The after treatment consists in attention to the general health of the child and irrigation of the cavity, should it show any tendency to close and allow accumulation of pus. Should this not be the case, it is unnecessary to annoy the child with irrigation, which, of course, has to be carried out in a partially inverted position.

It has been recommended to open a retropharyngeal abscess laterally through an incision made in front of the sternomastoid muscle. This route should only be followed in case the pus has already burrowed in that direction. Otherwise the dissection is difficult and not without risk, and the drainage is not always satisfactory by this route.

INFLAMMATIONS OF THE SKIN

Acute suppurations of the skin are described on page 32.

Eczema.—Eczema of the face or scalp is often accompanied, especially in children, by abundant secretion, which as it dries forms crusts. These in turn increase the itching, and as they are torn off, raw surfaces result, so that blood mixes with the serum in the formation of new crusts. It is not surprising under the circumstances that the skin becomes infected and local cellulitis develops, or possibly suppuration in the regional lymph nodes (see Fig. 77, p. 130). The risk of infection is greatest when the eczema involves the scalp of a young child.

n order to avoid the complications of infection,
saturated with sweet oil for some hours to

soften the crusts. These should then be removed and t gently but thoroughly washed with hot water and soap, hair cut short. Compresses saturated with such a lotion per cent aluminum acetate, or one half per cent creolin then be applied. When the inflammation has somewhat s Lassar's paste or boracic acid ointment should be used. I erally supposed that it aggravates an eczema to wash the s soap and water, but if this is gently done, the skin th dried, and some greasy application is at once made to re fat extracted by the soap, the benefits of cleanliness are without harmful results.

Whatever the remedy chosen, such general measures a improve the nutrition of the child should be attended scratching should be prevented, even though the hands be tied.

Ringworm.—Ringworm, whether of the non-ha scalp, or bearded face, is due to the growth in the skin (fungi. The disease is therefore contagious, and may mitted by contact or by an exchange of articles of clothin etc. The patient affected is usually a child or young ad tendency of the infection to spread equally in all direct the lesion a more or less circular appearance, and if affected contains few hairs the center of the area may sumed a normal appearance while the growth is still act periphery. The rate of growth varies, being at first m so that a ring an inch in diameter may be formed in in the non-hairy skin. Later, there is a tendency for t to die out, so that the ring may be incomplete or exi spots. If the ringworm occurs in the scalp or bearde scaliness observed upon the non-hairy skin is much ex crusts are added, and there is incomplete loss of the h the affected area.

Treatment.—The affected area should be washed scales and crusts by green soap and water. If the non is affected, the disease can be speedily cured by washi with a solution of bichlorid of mercury, two grains to of water. Other strong antiseptic solutions are equally If the hairy skin is affected, a depilatory should be ap rid of the stumps of hair. Stelwagon recommends a three drams of barium sulphid and two and a half drams each of zinc oxid and powdered starch. At the time of use, this is rubbed to a paste with a little water and applied for five to ten minutes and then washed off. Sulphur ointment, diluted if necessary, should be rubbed into the area every day or two. Another plan is to paint it with a solution of chrysarobin in chloroform, and to cover this with two or three coats of collodion. Many other antiseptics, both in salves and lotions, have been employed with success. One should persist in treatment until every trace of the disease has disappeared.

Ulcers.—Simple ulcers of the face occurring in marasmic persons, especially young infants, are readily healed if the general condition of the patient can be improved. Cleanliness and a simple dressing—for example, a wet dressing of creolin, one per cent—are the only local treatment needed. The question of syphilis ought always to be considered.

Anthrax, or malignant pustule, is found on the hands and arms perhaps more frequently than on the face and neck. It is described on page 132, where a clear picture of an early pustule is given.

Noma.—This is a localized gangrene of the face and mouth, usually seen in a person exhausted by some infectious disease. It begins in the mucous membrane of the gums or cheeks. The tissues are first indurated, and then become gangrenous. There is no fever. The process leads to perforation of the cheek, loss of the teeth, necrosis of the jaw, etc., and usually terminates in death within a week or ten days.

CHRONIC INFLAMMATIONS

Syphilis.—The primary lesion of syphilis is occasionally found in the lip or cheek or tongue. The unusual site of the lesion and the fact that it may be found here in the pure-minded, often lead to an error in diagnosis. Hence the exact appearance of the indurated sore is of great importance. Infection usually takes place through a visible break in the skin—a cigarette burn in one of the cases figured in the accompanying illustrations—but such a break will be obscured by the primary sore in a few days. In a week or two the induration and redness become marked.

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lymphatic glands are swollen, but are not very tender
later the scab falls off, and a shallow ulcer is formed (Fig. 23). As healing takes place the induration subsides, the ulcers become filled with granulations, and the epithelium grows over it. The only permanent disfigurement is a small scar containing, perhaps, a little pigment. This is insignificant when compared with the active lesion, so
respect the patient may be encouraged.

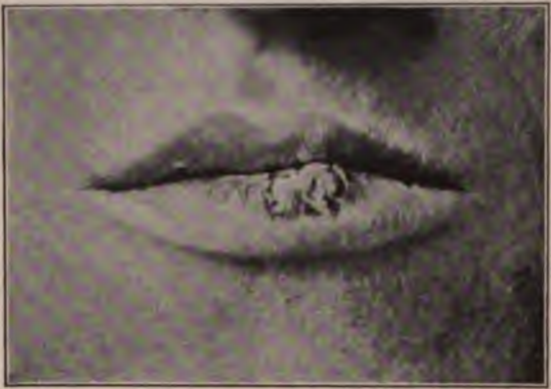

FIG. 20.—CHANCRE OF LOWER LIP OF NINE DAYS' DURATION. Patient a man aged thirty-six years.

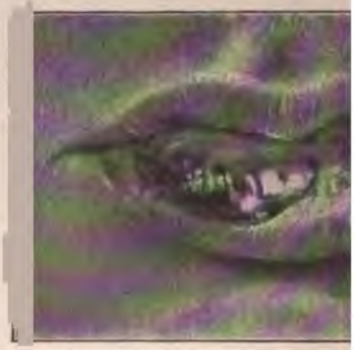

FIG. 21.—CHANCRE OF LOWER LIP O
DURATION. Patient a man a
years.

The persistence of the lesion for a week or more patient, and the large amount of induration without suppuration, serve to distinguish the primary sore of syphilis from a simple ulcer. The possible youth of the patient, and the disappearance of induration either with or without the use of antisyphilitic remedies, serve to distinguish it from cancer. Cancer is the more unlikely if the lesion is in the skin of the face, away from the mucocutaneous junction of the lip.

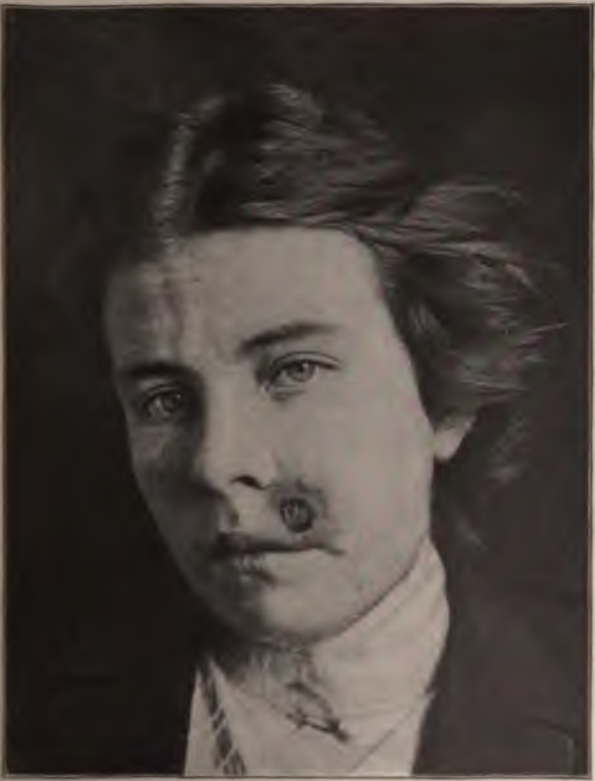

Fig. 22.—Chancre of Cheek, Developing in Burn from Cigarette. Duration of lesion 2 months.—Patient aged 19 years.

Treatment.—Local treatment, while not essential, relieves the feelings of the patient. The sore should be covered with a collodion dressing, or with simple ointment and a small patch of muslin. Mercuric ointment, on account of its suggestive color, should not be employed—at least by day. Internal treatment is all important. A tablet of $\frac{1}{4}$ of a grain of mercuric protoiodid

If the lesion is on the lip (Fig. 20), its development is similar to that of a chancre of the penis. There is the same elevated, comparatively painless swelling with shallow ulceration, but later the extent of the deep induration usually exceeds that found in an unmixed sore of the penis (Fig. 21).

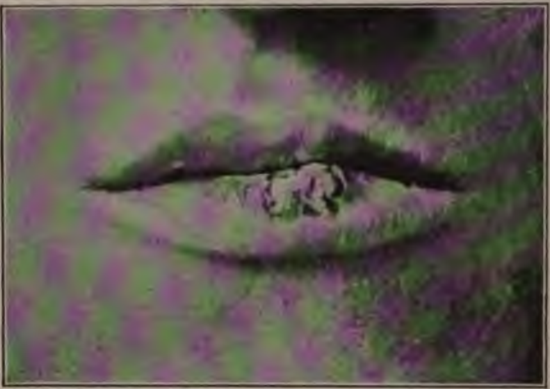

FIG. 20.—CHANCRE OF LOWER LIP OF NINE DAYS' DURATION. Patient a man aged thirty-six years.

When the primary lesion occurs in still thicker skin (for example, that of the cheek), this induration and the subsequent ulcer are still larger than is usually the case when the primary sore occurs in the genitals. In a few days the surface is covered with a dry scab (Fig. 22) if the lesion is out of the area bathed with the saliva. The regional lymphatic glands are swollen, but are not very tender. A few days later the scab falls off, and a shallow ulcer is formed (Fig. 23). As healing takes place the induration subsides, the ulcers become filled with granulations, and the epithelium grows over it. The only permanent disfigurement is a small scar containing, perhaps, a little pigment. This is insignificant when compared with the active lesion, so that in this respect the patient may be encouraged.

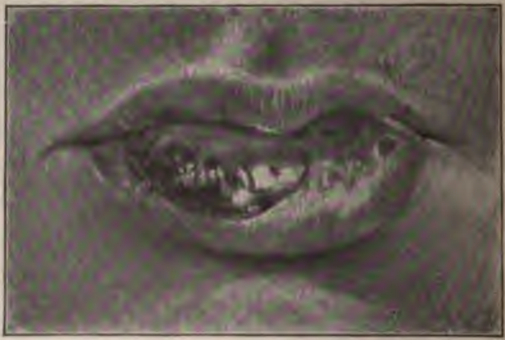

FIG. 21.—CHANCRE OF LOWER LIP OF THREE WEEKS' DURATION. Patient a man aged twenty-four years.

The persistence of the lesion for a week or more in a healthy

Mercuric ointment rubbed into the individual patches at night, and wiped off with a dry cloth in the morning, is thought to hasten the disappearance of these lesions. Occasionally a well-developed lesion may be mistaken for a new growth (Fig. 24).

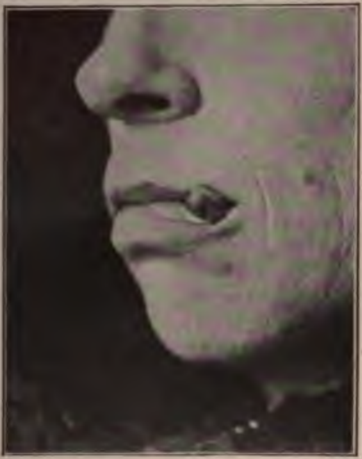

Fig. 24.—Papilloma of Lip, Found on Microscopical Examination to be Syphilitic. Duration of lesion 2 months. Patient aged 28 years.

Tertiary Lesions.—Gumma may develop in the scalp or face, or in the tongue or throat or nose. It produces a deep-seated ulceration which heals only after the permanent destruction of more or less tissue. There is also a chronic syphilitic thickening of the tongue known as glossitis. The whole tongue is harder and thicker than normal, and the mucous membrane in particular is furrowed and ridged and more shiny than normal. Gumma of the scalp often involves not only the skin, but the periosteum and a part of the skull, so that there may be necrosis of some portions of the outer table of the skull. The separation of these necrotic portions may require months. Until they are entirely removed complete healing is, of course, impossible. The pus which undermines the scalp around the margins of the sequestrum may require incisions for its perfect drainage. These late lesions of syphilis, with the exception of the glossitis, usually yield readily to antisyphilitic treatment, and especially to the administration of large doses of iodid of potash up to a dram three times a day. Local treatment is unimportant. There is no excuse for keeping a patient's face or head smeared with an offensive mercurial ointment. Mercury can be administered more pleasantly and more accurately by mouth or by injections or inunctions. Moreover, under suitable moist dressings, repair takes place more rapidly than when mercuric ointment is used. This has been demonstrated by careful measurements.

Tuberculosis.—When the skin is the seat of tuberculosis, the lesion is spoken of as lupus vulgaris. The face is the commonest

should be taken after each meal, or $\frac{1}{32}$ of a grain of mercuri
iodid with 10 grains of potassium iodid, well diluted in
Some physicians prefer treatment by injection—e. g., $\frac{1}{8}$ gr
bichlorid of mercury in water three times a week, or 5 to 8
of a ten per cent emulsion of the salicylate of mercury in all
once a week.

Secondary Lesions.—Mucous patches which develop i
mouth and throat during the secondary stage of syphilis in

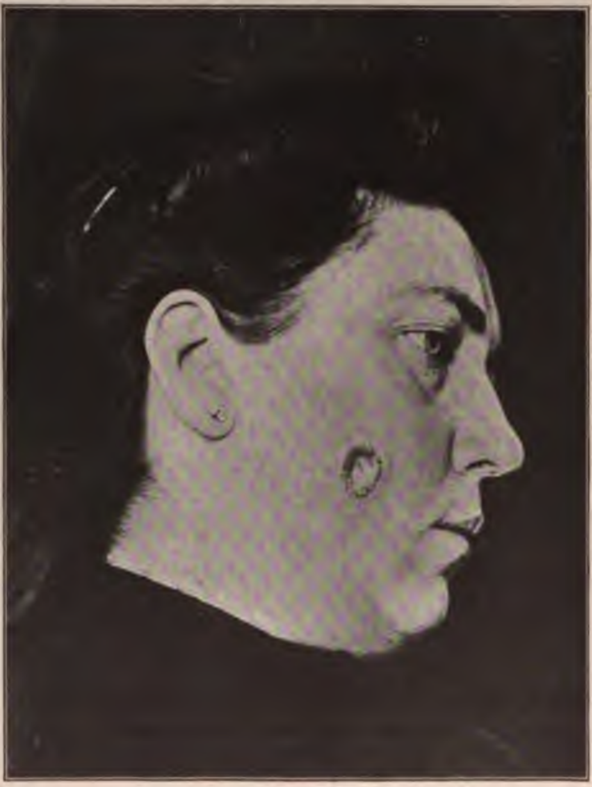

FIG. 23.—CHANCRE OF CHEEK FROM A BITE. The ulcer is granulatin

cases make the patient very uncomfortable, and may lead t
puration in the cervical lymph glands. Gargles and sprays o
antiseptics give some relief, but the chief treatment consists
regular administration of mercury and potassium iodid. T
ondary eruption on the skin of the face, and particularly
forehead, annoys the patient by calling attention to his d

Mercuric ointment rubbed into the individual patches at night, and wiped off with a dry cloth in the morning, is thought to hasten the disappearance of these lesions. Occasionally a well-developed lesion may be mistaken for a new growth (Fig. 24).

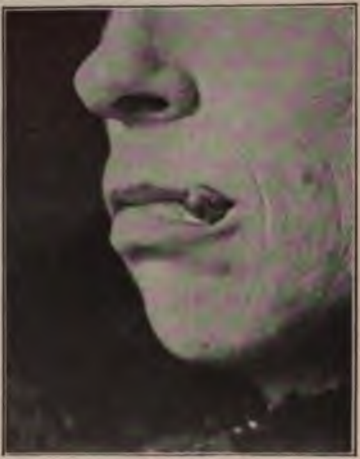

FIG. 24.—PAPILLOMA OF LIP, FOUND ON MICROSCOPICAL EXAMINATION TO BE SYPHILITIC. Duration of lesion 2 months. Patient aged 28 years.

Tertiary Lesions.—Gumma may develop in the scalp or face, or in the tongue or throat or nose. It produces a deep-seated ulceration which heals only after the permanent destruction of more or less tissue. There is also a chronic syphilitic thickening of the tongue known as glossitis. The whole tongue is harder and thicker than normal, and the mucous membrane in particular is furrowed and ridged and more shiny than normal. Gumma of the scalp often involves not only the skin, but the periosteum and a part of the skull, so that there may be necrosis of some portions of the outer table of the skull. The separation of these necrotic portions may require months. Until they are entirely removed complete healing is, of course, impossible. The pus which undermines the scalp around the margins of the sequestrum may require incisions for its perfect drainage. These late lesions of syphilis, with the exception of the glossitis, usually yield readily to antisyphilitic treatment, and especially to the administration of large doses of iodid of potash up to a dram three times a day. Local treatment is unimportant. There is no excuse for keeping a patient's face or head smeared with an offensive mercurial ointment. Mercury can be administered more pleasantly and more accurately by mouth or by injections or inunctions. Moreover, under suitable moist dressings, repair takes place more rapidly than when mercuric ointment is used. This has been demonstrated by careful measurements.

Tuberculosis.—When the skin is the seat of tuberculosis, the lesion is spoken of as lupus vulgaris. The face is the commonest situation for this disease, especially the skin of the no cheeks. A number of reddish areas as large as a pea, p are first noticed in the corium. They pale on pressure, ing yellowish or brownish. As the disease spreads, the tiss involved may ulcerate, or it may atrophy and become cic in character. As the course of the affection is a very chron often lasting for years, the appearances of the lesion vary and a variety of names have been applied to indicate these ent stages, the minute description of which will be found book upon skin diseases.

DIAGNOSIS.—Small patches of lupus may be confounde psoriasis, but inquiry into the history will usually serve t nate this error. The lesions of psoriasis are persistent, but involve the deeper parts of the skin, do not extend so s and do not ulcerate. Lupus may also be confounded with ulcer. In this disease the destructive process is more able, while the reparative is less so; but in certain i a microscopical examination may be necessary to diffe the two.

TREATMENT.—The diseased tissue may be removed curette, or by caustics, or by the knife. The advance of the has sometimes been checked by linear scarifications abo eighth of an inch apart and crossing each other at right Ultra-violet rays and the x-ray have also been employed wi effect in many cases. These last-named agents have the destroying the pathologic tissue with far less resulting sc chemical caustics or the knife.

Tuberculosis of Nose and Mouth.—Tuberculosis of t mouth, or throat is of rare occurrence, and when seen is secondary to tuberculosis of the lung. It appears in tw either productive or ulcerative. Both processes may be e in a single lesion. It may be difficult to differentiate tub from syphilis until a microscopic examination of an exci tion of tissue has been made, or the patient has been subj treatment by mercury and iodine.

Tuberculosis of the mouth, secondary to the pulmon ease, is shown in the accompanying photograph (Fig. 25)

TREATMENT.—General hygienic treatment is important treatment, such as the application of caustics or the part sion of tuberculous tissue, has little effect upon the progress of the disease, while in this situation a thorough excision is impossible.

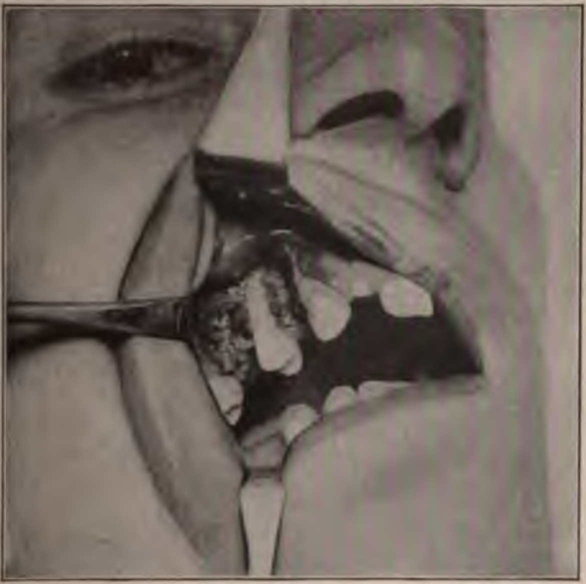

FIG. 25.—TUBERCULOSIS OF THE GUM, SECONDARY TO PULMONARY TUBERCULOSIS.

Actinomycosis.—This should be borne in mind as one of the chronic inflammatory lesions liable to occur in the face, and especially about the mouth or jaw. It begins as a smooth swelling, but later abscesses form and discharge pus containing yellowish granules. These may be recognized by the naked eye or under the microscope as colonies of the ray fungus. They are characteristic of the disease. The fungus of the disease in man is similar to, but probably not identical with, that of the disease in cattle called "lumpy jaw."

Treatment consists in the excision of diseased tissue, and the administration of iodid of potash. The results are not very satisfactory in many cases.

CHAPTER III

TUMORS AND DEFORMITIES OF THE HEAD

CYSTIC TUMORS

Milium.—There are often found in the skin of the face, cially near the eyes, and also in the skin of the external ger male and female, little whitish masses. They are called They are made up of closely packed epithelium and seba material, and are situated just beneath the epidermis. A m is distinguished from a comedo, or blackhead, by the fact there is no obstructed duct in the epithelium which covers it. nature of this small tumor is in doubt.

Milia show little tendency to change their form. As the persistent, their removal is often requested by the patient. overlying epidermis should be split with the point of a small scalpel and the contents expressed. This method is less p and more successful than attempts to pick out the mass w needle.

Comedo.—A comedo, or blackhead, is the lesion pro by the blocking of a sebaceous duct. The dark color is due admixture of dust with the sebaceous material. They are often found upon the face and neck.

The general treatment which is given for acne (p. 33) service. After the skin has been softened by hot bathin individual plug may be loosened by a needle and squeezed lateral pressure. This pressure should in all cases be sligh a sluggish inflammatory process be converted into an acute

Sebaceous Cyst.—The tumor of the head that most attracts notice is a sebaceous cyst. These cysts occur either or in groups, and vary in size from the smallest nodule whi be recognized to a sac two inches or more in diameter. Th commonest in the scalp, but also occur behind the ear, in t brow, or (in males) in the skin from which the beard s

They are found in young adults, but are most common in those of middle age. They are due to the blocking up of the duct of a sebaceous gland. The sebaceous material manufactured by the gland collects within its lumen and gradually distends its cavity. As the distention increases, the epithelial lining is also increased by a multiplication of its cells. Within such a cyst are found the cast-off epithelial cells in a state of fatty degeneration. The material contained in a small cyst is semisolid and pasty, while that contained in a large one is usually more fluid. The tumor grows rapidly at times, but often has long dormant periods during which it seems not to grow at all.

Diagnosis.—The cyst at first grows within the skin, and cannot be moved independently of it. As it increases in size, it spreads in the areolar tissue beneath the skin. It follows, therefore, that in the case of a large, non-inflamed cyst, the overlying skin is movable upon it at all points excepting at the center. This single fact will usually serve to differentiate a sebaceous cyst from a wholly subcutaneous tumor—for example, a lipoma.

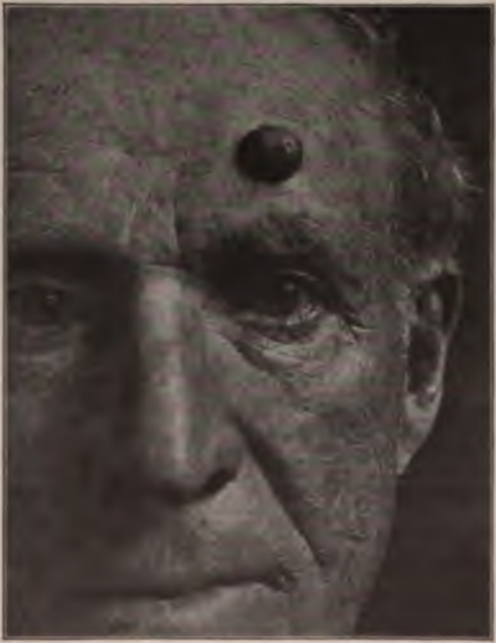

Fig. 26.—Sebaceous Cyst of Forehead, Moderately Inflamed, and About to Rupture.

If left to itself, a sebaceous cyst may attain a considerable size, possibly having a diameter of two inches, if it is situated in the scalp. The usual fate of a sebaceous cyst situated in the face is to undergo inflammatory changes (Fig. 26), possibly with rupture and discharge of its contents. Such a discharge is, however, but temporary, as the sac generally refills in a short time.

TREATMENT.—Treatment of a sebaceous cyst is operative. guard against its recurrence, one should remove the whole sac. operation to accomplish this is readily performed under co unless the patie more than usı sensitive.

In the cas a sebaceous cy the scalp, one sh proceed as foll First shave cleanse an are the scalp a larger than tumor (Fig. While shaving to the conven of the operato not absolutely essary, and pri union can us be obtained wi it. In certain therefore, it m better not to fice any of the The rest of head outside of the field of operation should be covered towels wrung out of bichlorid solution, 1:1,000. A few of one per cent cocain solution are next injected along the of incision. This weak solution is desirable in these cases, cocain injected into the head appears to have a more pronou toxic effect than when used in other portions of the body. writer has known the injection of a few drops of a four per solution of cocain into the median line of the scalp to produce a marked reaction that artificial respiration was twice nece before its effect passed off.

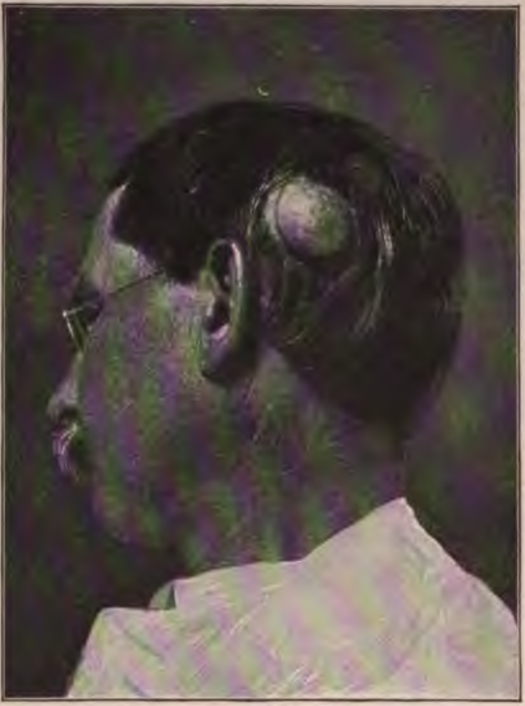

FIG. 27.—OPERATION FOR SEBACEOUS CYST OF SCALP. Skin prepared.

A straight incision should be made directly across the c of the tumor, from one edge to the other, extending down t sac without entering it. If the correct tissue-plane is reached, it is usually possible to sweep around the entire sac with the handle of the scalpel, or with a curved, closed scissors, and in this manner to lift the sac out without rupture (Fig. 28).

If, however, the sac is ruptured, the operator need not fear that the contents will infect the wound. If this is a risk at all, it is certainly a very slight one, since primary union regularly follows operation in all non-inflamed cases. Even when suppuration is present, union of the sutured skin is often obtainable.

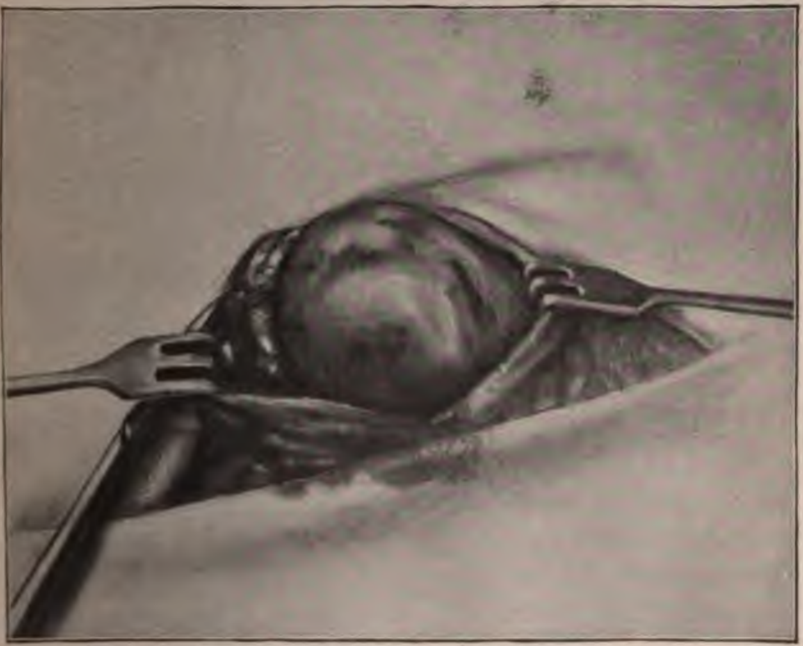

FIG. 28.—OPERATION FOR SEBACEOUS CYST OF SCALP. Skin divided to the sac and retracted.

If the sac is ruptured, its contents should be at once evacuated, and the sac itself peeled out or dissected out. If the cyst is a large one, there will be considerable redundant skin after the sac has been removed (Fig. 29). This will shrink in time, so that it is not usually necessary to cut any of it away.

The wound should be closed by interrupted sutures of fine black silk or horsehair, and pressure applied most carefully to prevent the formation of a blood clot. For this reason a bandage

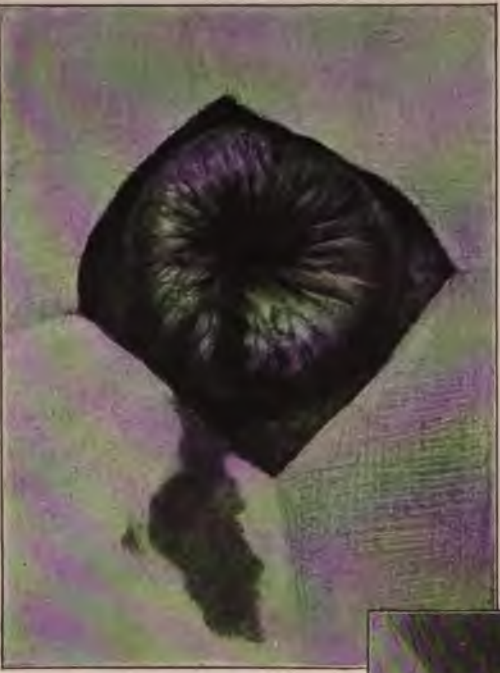

FIG. 29.—OPERATION FOR SEBACEOUS CYST OF SCALP. The redundant skin collapses after the removal of the sac.

about the head, least for two or t days, is necessary cept in the case very small cyst. ter that a cotton lodion dressin preferable.

A sebaceous of the face or be the ear is more a suppurate than of the scalp. suppuration is of a mild character it does not usuall feat primary union if the sac is dissected away. It does make it very difficult to recognize the wall of the sac, however, and unless the wall is entirely removed recurrence will take place. If, therefore, the abscess is pronounced, it is better to lance and drain it, explaining to the patient that the sac will later fill again with sebaceous material and must then be removed (Fig. 30).

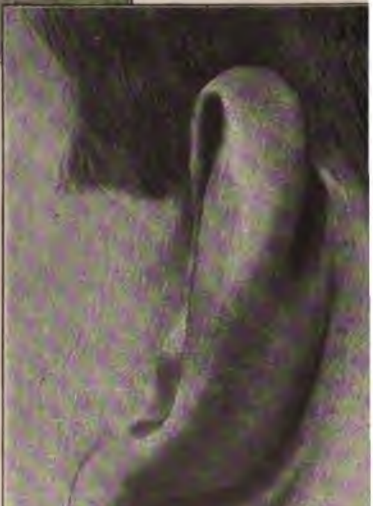

FIG. 30.—INFLAMED SEBACEOUS CYST B THE EAR. Of many months' duratio fected three days.

An interesting case in which a tumor growing from or beneath the skull and lifting the scalp was erroneously diagnosed as a sebaceous cyst, is described on page 105 with an accompanying illustration.

Mucous cysts may appear in any portion of the mouth as the result of obstruction to the secretion of a mucous gland. They are more common on the inner surface of the lips and cheeks. They are extremely thin-walled, and are filled with a clear, glairy fluid. It is not possible to dissect out the filmy sac, nor is this necessary, for if a triangular or circular portion be cut from the mucous membrane overlying the sac, the latter will be destroyed by granulation during the healing process, so that recurrence need not be feared.

Ranula, or Sublingual Salivary Cyst.—Sometimes a duct of one sublingual gland becomes obstructed, and as the saliva accumulates a soft cyst forms under the tongue called a ranula (Fig. 31). In rare cases both sides are affected at once. If the cyst

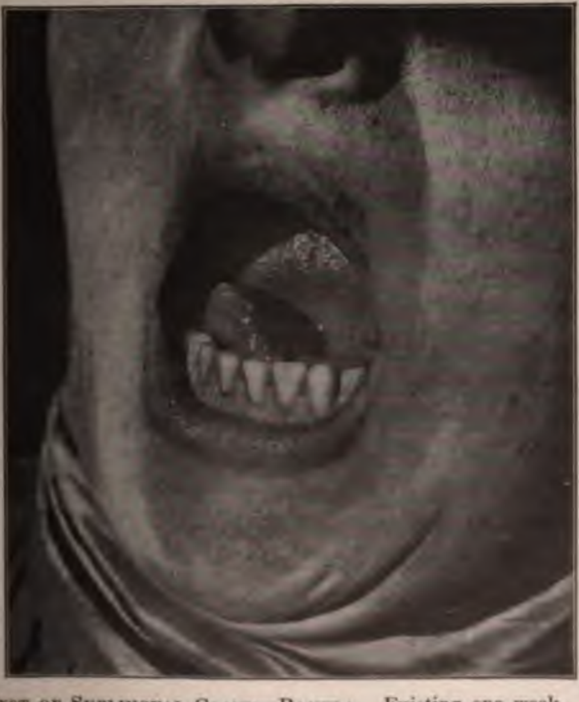

FIG. 31.—CYST OF SUBLINGUAL GLAND—RANULA. Existing one week. Patient, a woman aged twenty-eight years.

is pricked with a scalpel a teaspoonful of viscid opalescent may be expressed. A portion of the wall of the sac shoul excised, and a rubber tissue drain kept in if possible for se days, in order to give the epithelium of the mouth time to with that lining the cyst. Otherwise the cyst will refill an operation must be repeated.

Simple Parotid Cyst. —A similar retention cyst ma velop from some portion of the parotid salivary gland. As i under the skin of the cheek, and is not attached to it, it is readily mistaken for a lipoma. It should be removed *in* and if its attachment to the gland is a close one, allowance be made for a continued salivary discharge. If the wound is pletely sutured it will almost invariably fill up with a mi of saliva, serum, and leucocytes. It is better, therefore, to a minute drain—for example, four or five horsehairs or th twisted together and doubled or a flat gutta-percha drain—i wound, which should elsewhere be sutured. This will allov slight secretion to escape, and in the course of a few days or pe a few weeks the discharge will cease, and in time the indu nodule caused by the granulation of the little cavity will ent disappear, leaving not so delicate a scar as would have res from removal of a tumor with primary union, but one whi not very noticeable.

Dental Cyst.—A cyst sometimes forms by the side of a of a decayed tooth. The fluid collects slowly and withou usual signs of inflammation (Fig. 32). When evacuated found to be of a mucous character clouded with epithelial d Such a cyst is thought to be due to overgrowth of remnan cells concerned in the embryonic development of the teeth. cyst forms within the bone, and its projecting portion is part wholly covered by a thin layer of bone which may crackle palpated. The exposed wall of the cyst should be cut away its cavity filled with iodoform or other antiseptic gauze an lowed to heal by granulation from the bottom.

Dermoid Cyst.—A dermoid cyst is of congenital origin occurs in one of the lines of embryonic closure of the skin may be apparent at birth, or it may not be noticed until years afterward, when its increase in size first attracts the a tion of the patient or some friend. Some dermoid cysts are up of a single layer of epithelium, with sebaceous contents, in which a few hairs are sometimes found. If the attachment of the dermoid cyst to the deeper structures is slight, its removal is almost as simple as the removal of a sebaceous cyst. Some dermoid cysts have extensive deep attachments, so that their removal is difficult and may be followed by a permanent scar. It is of the greatest importance, therefore, that a correct diagnosis of dermoid cyst be made before its removal is attempted.

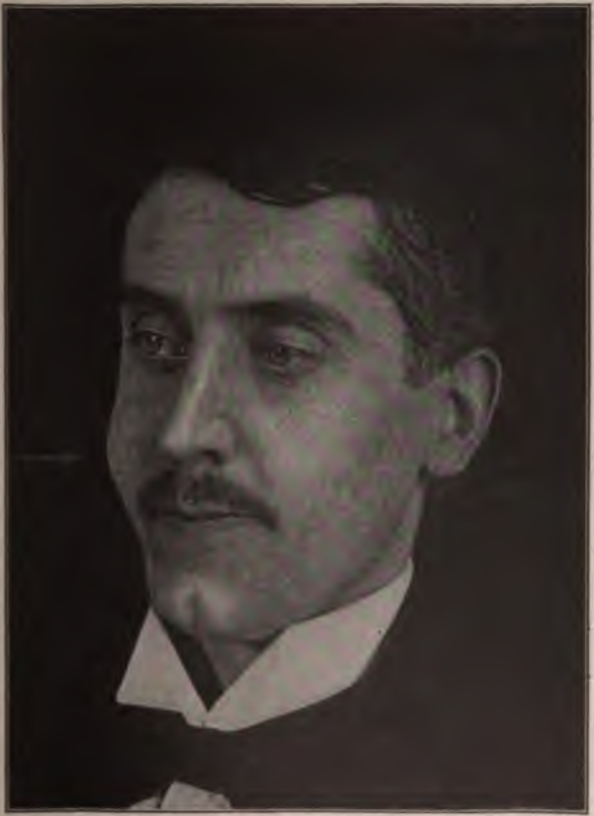

FIG. 32.—DENTAL CYST OF SIX WEEKS' DURATION. There was freely movable skin and absence of heat, redness, edema, and tenderness, but the cyst was mistaken for alveolar abscess.

DIFFERENTIAL DIAGNOSIS.—A mistake in diagnosis lies chiefly between a dermoid cyst and a sebaceous cyst; hence the importance of considering in detail the points of difference. The common situations in which sebaceous cysts are found have already been

spoken of. They include nearly all the situations in which
moid cyst of the head is likely to be found. Dermoids
chiefly about the inner or outer angle of the orbit, or in
of or behind the ear (see Figs. 33, 34, and 35). A sebaceou
is rare in childhood; dermoids occur in infancy, childhood
adult life. A sebaceous cyst is always attached to the skin
point; a dermoid is usually covered by normal, freely mo
skin. A sebaceous cyst is invariably movable with the sk
the deeper struct
the base of a derm
invariably attache
the deep facia or t
periosteum, or, in
of the ear, to the
chondrium. This
is not always eas
make out, since the
superficial portion
dermoid cyst may
back and forth up
own fixed base, b
slide the cyst as a
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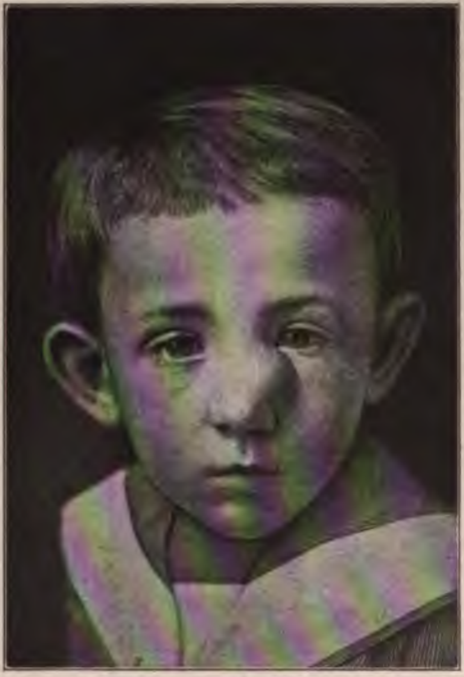

Fig. 33.—Dermoid Cyst of the Nose, Noticed Soon After Birth.

During the oper
it will be noticed
the sac of a dermoi
is usually thicker
that of a sebaceous cyst, and that this is especially true
deeper portion. Furthermore, the attachment of its base wi
come more and more manifest as an attempt is made to diss
free. It can never be freed by blunt dissection, since it is an
ically connected with the deeper tissues. If it contains hair
diagnosis is certain.

A dermoid cyst which contains little sebaceous matter and
not fluctuate may be mistaken for a lipoma or a small, deep-s

angioma. The size of the latter can always be reduced by compression, but it is promptly restored when the relief of pressure allows the blood-vessels to refill.

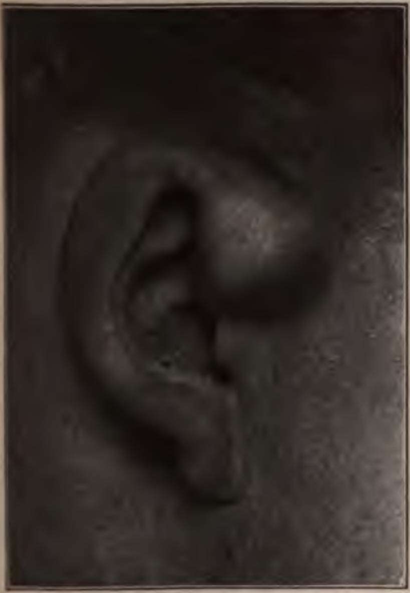

FIG. 34.—DERMOID CYST IN FRONT OF THE EAR, GROWING FOR FIVE YEARS. Patient aged twenty-two years.

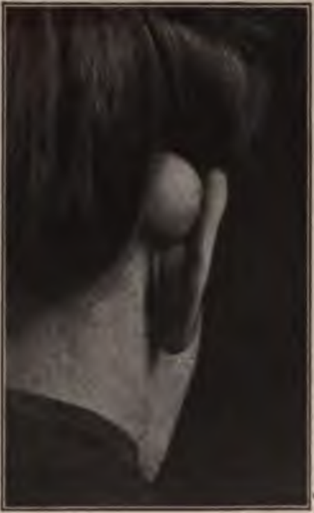

FIG. 35.—DERMOID CYST BEHIND THE EAR, CLOSELY RESEMBLING A SEBACEOUS CYST IN EXTERNAL APPEARANCE. Patient aged 24 years.

TREATMENT.—The incision for the removal of a dermoid cyst near the orbit should be made through the eyebrow, the hair first having been shaved off, or it should follow the direction of a wrinkle in the forehead or about the angle of the eye, so that the scar shall be insignificant. The separation of the overlying skin from the cyst is easily accomplished, while the dissection of the base of the cyst from the bone may be difficult. For this reason, unless the patient is of a very quiet and courageous disposition, it is better to give a general anesthetic, as it is difficult to obtain complete anesthesia of the part of the cyst adherent to the periosteum by means of cocain or eucain. After most of the sac has been freed, it should be split open and emptied, so that the operator may know exactly how far its cavity extends. Sometimes the cyst can be dissected free from the periosteum without injury to the latter. More often a part of its base is really formed by the periosteum, so that the complete removal of the cyst will necessitate tl moval of a little periosteum. This is not a serious matt necrosis will not follow unless the wound suppurates. The ative wound should be sutured and a firm dressing appli obliterate the cavity due to the removal of the cyst.

When the dermoid cyst is situated in front of or behir ear, it may be so closely associated with the cartilage of the tory canal that its inner portion reaches to the base of the Under these circumstances, as much of the cyst as is acce should be removed and the remainder should be cauterized carbolic acid.

Congenital Sinus.—The first pharyngeal cleft term just in front of the ear. This is a region in which inclusion and sinuses are found. Such sinuses are often similarly pla front of both ears. They are usually small, and being lined the normal skin, secrete very little. They may become obst and form cysts.

The only satisfactory treatment is the removal of the sinus or cyst by dissection. Any epithelial remainders are develop into cysts.

The sinuses formed by the partial closure of the lower yngeal clefts are described in the section devoted to affecti the neck (p. 137).

BENIGN SOLID TUMORS

Papilloma.—This tumor growing from the skin or m membrane usually resembles a more or less pedicled wart. composed of fat and fibrous tissue covered with essentially n skin.

Treatment.—It may be snipped off level with the ski if at all sessile its base should be removed by two incisions, remove an elliptical portion of skin containing the base tumor. This guards against recurrence, and permits the s closure of the wound. A papilloma of the lip may be mis for the primary lesion of syphilis; that of the skin for a (Fig. 36).

Mole.—A mole is a congenital pigmented fibroma of th more or less elevated above the surface. Sometimes in ad to its excessive pigment, a mole contains hairs abnormally large for the situation in which they occur.

While most moles persist for life without undergoing any change, a few take on sarcomatous growth, either on account of external irritation or for some unknown reason. For this reason one is justified in removing any mole. They are chiefly removed, however, on account of their unsightly appearance.

TREATMENT.—In removing a mole, one should be careful to take away all the cells of which it is composed, lest those remaining be stimulated to increased growth. For this reason caustics, whether chemical, thermal, or electrical, are not to be recommended. Excision is the method of choice, and may be performed in two ways.

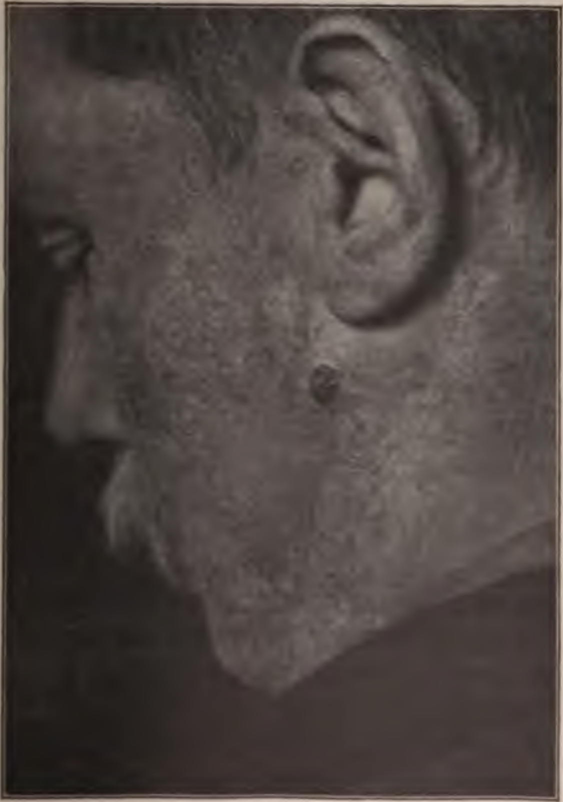

FIG. 36.—PAPILLOMA OF SKIN OCCURRING IN A SCAR, DIAGNOSED AS CANCER. The diagnosis was corrected by microscopical examination. Compare Fig. 54, p. 96.

If the mole is small it should be seized with fine mouse forceps and elevated slightly above the surrounding skin. I then be snipped off with a sharp scalpel or a pair of curvec sors. No local anesthetic is necessary. When the removal is erly done, all of the pigmented tissue is removed, and in its there is a small oval loss of epithelium. This defect heals w permanent scar.

In the case of larger moles, especially if they are so si that a linear scar will not be objectionable, a different metl removal is preferable. The mole should be excised, togethe the underlying portion of the true skin. The area of skin in should first be cocainized. An ellipse is then marked out, l the mole as its center. The cut which separates this sect skin should everywhere be perpendicular to the surface, in that the cut edges may fit exactly when sutured. The remc the elliptical portion of skin is sometimes followed by hemor This can usually be stopped by a few minutes' pressure, crushing the bleeding vessel with an artery forceps. Th step is to undermine the surrounding skin for a distance of s of an inch or less, so that the tension upon the sutures n slight. If the skin is lax, as it is about the eyes, this ste be safely omitted. If the skin is firm and is not undermin scar may stretch after the removal of the sutures until it is as broad as the portion of skin which was removed.

One or two horsehair or fine silk sutures should be in It is well to remove these in three or four days, so that the be no permanent marks to indicate the stitch holes. Tensio the scar may thereafter be reduced by a strip of adhesive

Lipoma.—A lipoma is a tumor composed of fat with a mum of fibrous tissue. It usually has a well-marked capsu

Lipoma of the face is most often found in the forehead, it forms a smooth, flattened tumor usually about three-fou an inch in diameter (Fig. 37). Its attachment to the s slight, being noticeably less than the attachment of a seb cyst. Moreover, the tension within the sac of a sebaceous usually greater than that within the capsule of a lipoma. well known that an encapsulated tumor will sometimes flu although it contains no fluid. This is particularly true of a of the forehead, which gives just as good a fluctuation w account of the hard bone beneath it as a sebaceous cyst can give. A sebaceous cyst is more globular than a lipoma, and projects far more above the level of the surrounding skin (cf. Fig. 26, p. 67).

TREATMENT.—If left alone a lipoma shows little tendency to increase in size, but it is so conspicuous that its removal is desirable. This is easily accomplished if the lobules of fat are large and the capsule well defined.

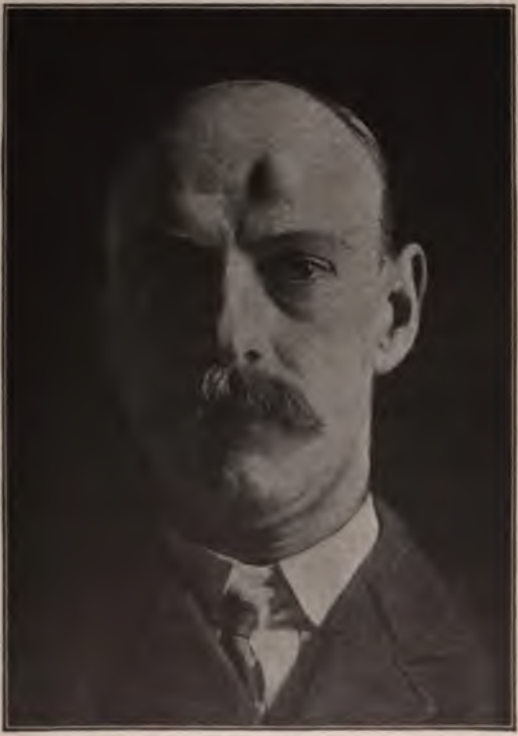

FIG. 37.—LIPOMA OF FOREHEAD, DURATION ONE YEAR.

The skin is cocainized, and an incision made across the center of the lipoma in the direction in which the scar will be least conspicuous. This is in a horizontal direction in the case of the forehead. The incision should divide the skin and also the capsule of the lipoma. When this has been done, the lipoma itself can be shelled out by blunt dissection with little difficulty. If one finds the dissection difficult, it is certain that he is not following the plane between the capsule and the lipoma proper. As this tumor shows no inclination to recur, it is unnecessary to remove the capsule. The wound should be closed by interrupted sutures, or the sutures may be omitted, since in this situation there is little tendency for the cut edges to retract. The best dressing is a cotton-collodion one.

Fibrolipoma.—A fibrolipoma of the head has the usual characteristics of this tumor when found in other portions of the body (p. 185). A fibrolipoma in an unusual situation is in Figure 38. Its attachment was to the skin of the e auditory canal.

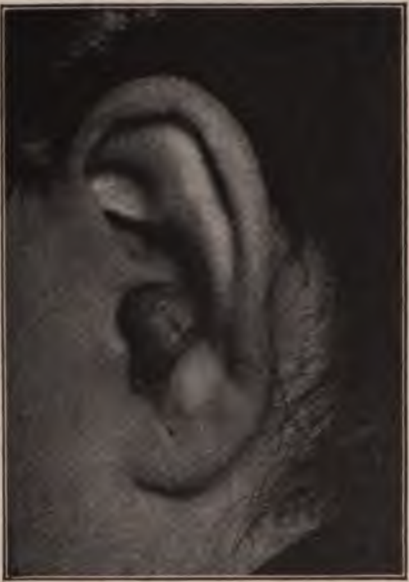

FIG. 38.—FIBROLIPOMA OF AUDITORY CANAL, DURATION ONE YEAR. Patient, aged nineteen years.

Angioma.—Angio the face is of comm currence in early i A small patch of capillaries and veins, called a nevus, may b ent at birth. This les creases rapidly, so tha treatment is desirable der to avoid unsightly d ity. The vessels dila usually those of the ficial portion of the s though in some instan deeper vessels alone fected, or it may be t center of the nevus the surface of the ski its edges extend in deeper portions of th but are covered with normal epithelium. If the angioma the surface it can scarcely be confounded with anything e a deep angioma containing much fibrous tissue may be ta a fibrolipoma. Possibly a contusion with hemorrhage i loose tissue around the eyelids might be mistaken for a co ing nevus, but the lapse of a few days would suffice to dist the two. Pressure upon a vascular tumor empties its vess makes it white. As soon as the pressure is removed, the immediately refill. Pressure upon effused blood causes it pearance only to a slight degree. This difference is mos ingly shown if the pressure be made with a bit of transpare so that the effect can be seen through it.

TREATMENT.—Capillary angiomata are successfully tre punctures with a fine needle which constitutes the negative an electric battery. For this purpose the battery should from a dozen to thirty small cells. The positive pole sho moist sponge, while a fine cambric needle or, better still, a jeweler's brooch is screwed into the handle connected with the negative pole. The sponge is held closely against the face while the needle is thrust into the skin at right angles to its surface from one-fourth to one-third of an inch. It is important that the needle inserted should be the negative pole, for if it is the positive pole bubbles of oxygen will form around it and will produce upon it oxid of iron, some of which, remaining in the tissues after the needle is withdrawn, may cause a permanent discoloration. The current should be sufficiently strong to produce a white zone about the needle one-eighth of an inch in diameter in ten or twenty seconds. If it is too strong the escharotic action is too vigorous and a permanent scar is produced. If it is too weak the cauterization is insufficient and the puncture is apt to bleed badly when the needle is withdrawn. If the battery is freshly filled, eight or ten cells are usually sufficient. Half a dozen punctures may be made at one sitting, and the treatment may be repeated twice a week. The pain is intense, and a cool assistant is required to hold the head and arms of the child. No anesthetic is required, as the pain does not continue after the removal of the needle, and even a delicate baby suffers no injury from the treatment. If the punctures are judiciously made, and the treatment is continued until every red vessel disappears, a satisfactory result will be obtained in most instances, and in place of the angioma there will be a cicatrized area marked here and there by little pits due to too vigorous cauterization. If the nevus is wholly superficial and only capillaries are involved, the scar will be extremely slight. The site of a deeper tumor, especially if it contains larger vessels, will be marked by a thickened and more abnormal patch of skin. It may be of advantage to perform a partial excision of such a nevus at some stage of the treatment by electrolysis.

Another method of treatment by which good results are obtained is the coagulation of blood in the vessels by the injection into the nevus of a few drops of water almost at the boiling point. The effect of heat applied in this way should be great enough to produce coagulation, as shown by the immediate pallor in the portion of the nevus so treated. After a few days the permanent effect of the treatment will be manifest, and if red spots remain additional injections should be made.

Treatment by Operation.—If an angioma is made up of larger vessels, either veins or arteries, it is readily compressible and may pulsate (Figs. 39 and 40). Electrolysis is useless in such a case, and the tumor must be removed by operation or its vessels ligated. This operation is serious in the case of an infant, for the bulk of its blood is so small that it will succumb to a hemorrhage which does not seem large to one accustomed to operate only upon adults. Even when the operation is upon an adult, every precaution should be taken to limit the hemorrhage. There should be plenty of artery clamps at hand. One assistant should have nothing to do except to control hemorrhage by pinching the surrounding skin or pressing it against the skull. Even then the bleeding will not be under perfect control, since the vessels of the tumor often anastomose with the veins inside of the skull. As fast as the incision is made the cut vessels should be clamped. If there is plenty of skin to cover the wound without using any of

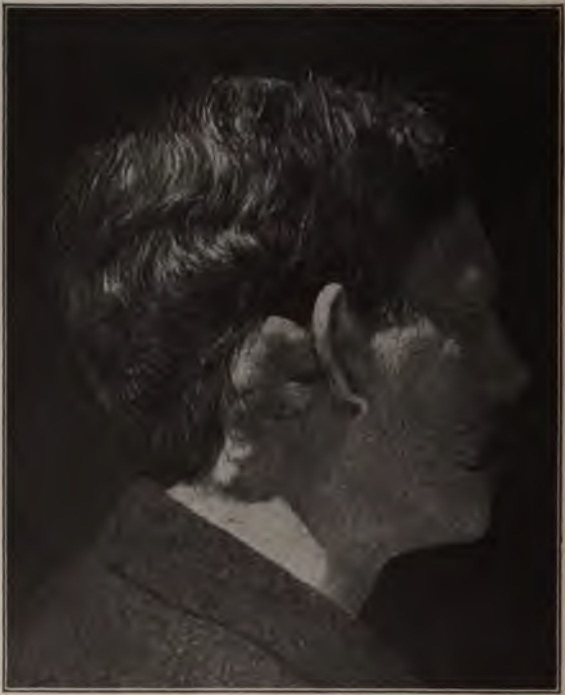

Fig. 39.—Pulsating Angioma of Scalp, Congenital. The photograph shows it fully distended.

that which covers the vessels of the tumor, the whole incision should be made before the base of the tumor is cut into. In this way much of its blood-supply will be shut off before the most difficult part of the operation, namely, the dissection of the base, is attempted. If the skin of the tumor is needed, one lateral incision should be made, the base next dissected, and the collapsed tumor cut away from as much of the overlying skin as is needed to cover the wound, which should be accurately closed by suture. The dressing should be a firm one, but sufficiently elastic, so that the pressure exerted may not threaten the vitality of the skin.

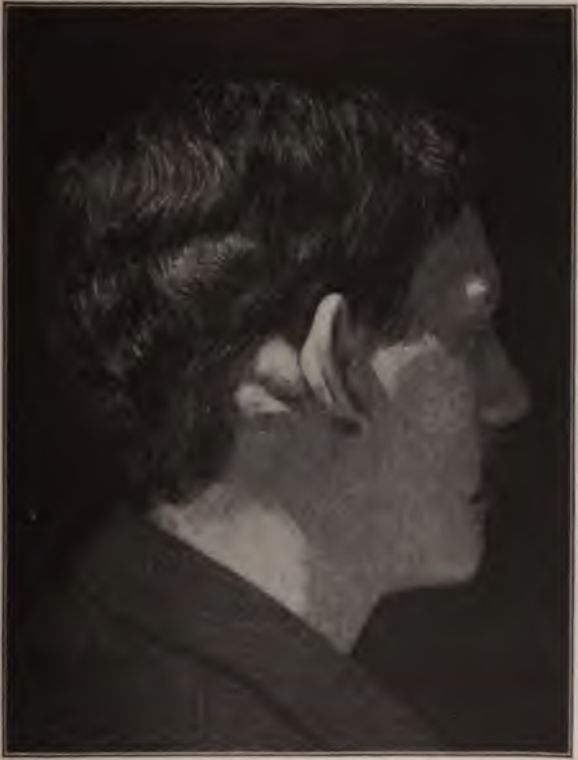

FIG. 40.—SAME TUMOR AS FIG. 39, BUT PHOTOGRAPHED IMMEDIATELY AFTER THE FINGERS WHICH WERE USED TO COMPRESS THE TUMOR HAD BEEN REMOVED. As the volume of the tumor increased very rapidly when released, this figure does not show it at its smallest.

Acne Hypertrophica.—This is an overgrowth of the nose, which is generally considered to be one of the forms of acne rosa-

cea, but is here included with the tumors to which it belongs
cally, for the appearance of the lesion and the treatment wa
this classification (Fig. 41).

This is a disease of middle life, or later, marked by a
overgrowth of the sebaceous follicles, with their ducts, as w
of blood-vessels and fatty tissue. The skin itself is not g
thickened, and may even be thinned, apparently the result of
stretching it. The tumor as a whole is soft and flabby, of dar

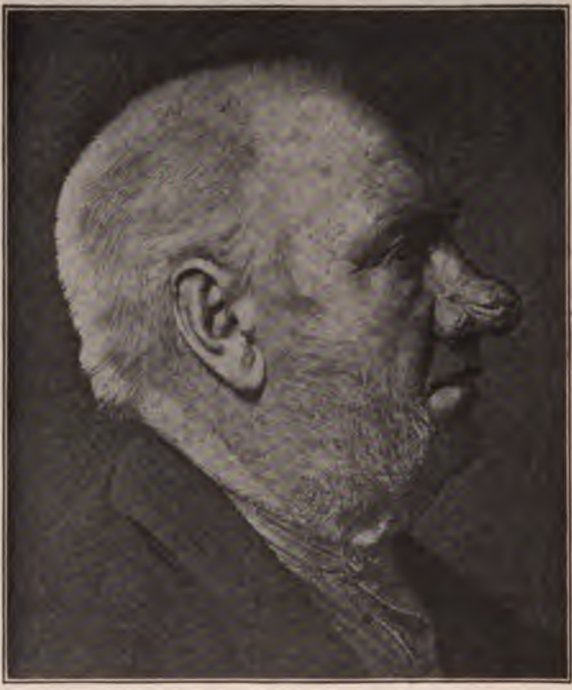

FIG. 41.—ACNE HYPERTROPHICA OF THE NOSE, OF SEVEN YEARS' DURATION.
aged sixty-nine years.

color, due to the venous congestion. It is not necessarily the
of alcoholism, and many of these patients are unjustly accu
intemperate habits.

Lesser degrees of hypertrophic acne of the nose are freq
found. Such an extreme overgrowth as is shown in Figures 4
43 is decidedly exceptional, although even more marked ins
are occasionally seen.

Although this overgrowth is benign in character, the exc tissue should be removed, as this can be accomplished without much risk, and the feelings of the patient will thereby be spared many mortifying remarks.

TREATMENT.—This consists in the removal of wedge-shaped pieces of the growth, so that the normal contour of the nose may be restored. The spongy tissue is very insensitive, so that a small amount of a dilute solution of eucain or cocain is sufficient. Hemorrhage is free, but may be controlled by pressure and ligatures. Although these patients are usually plethoric and stand very well the loss of blood, it may be advisable to remove only a portion of the growth at one sitting. This plan has the further advantage of enabling the surgeon to observe the effect of a partial removal of the tumor before completing the task. Removal may be effected in such a way that pedicled flaps are utilized to cover the raw

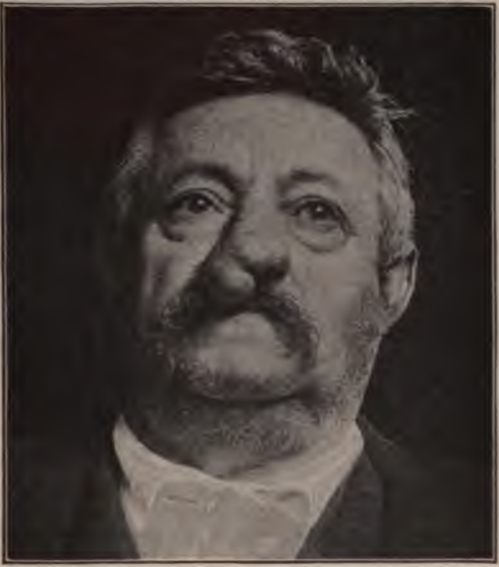

FIG. 42.—ACNE HYPERTROPHICA OF THE NOSE, FOUR YEARS' DURATION. Front view.

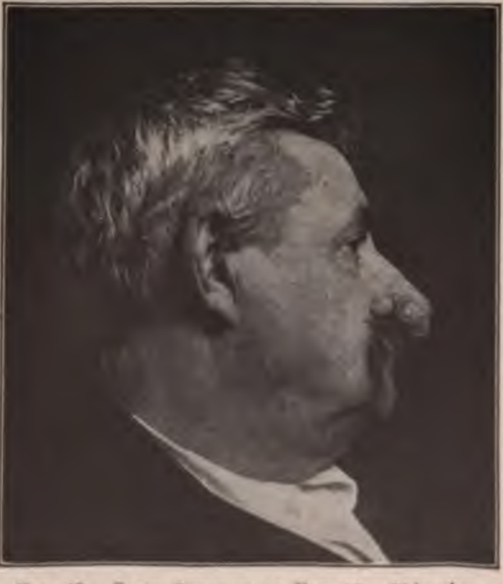

FIG. 43.—SAME SUBJECT AS FIG. 42. Side view.

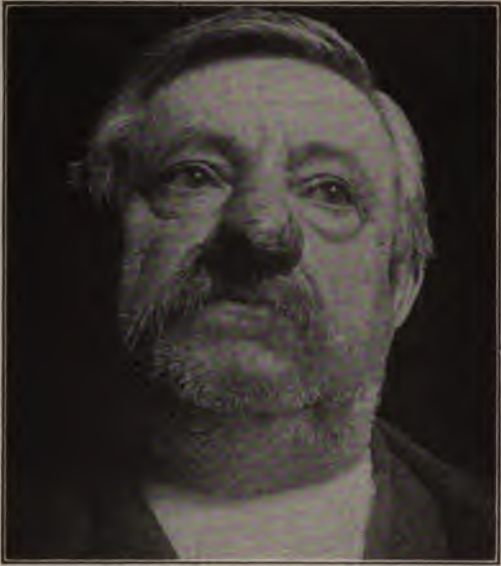

FIG. 44.—SAME SUBJECT AS FIG. 42, SHOWING THE RESULTS OF OPERATIVE TREATMENT FOR ACNE HYPERTROPHICA OF THE NOSE; THREE WEEKS AFTER FIRST OPERATION, AND ONE WEEK AFTER SECOND OPERATION.

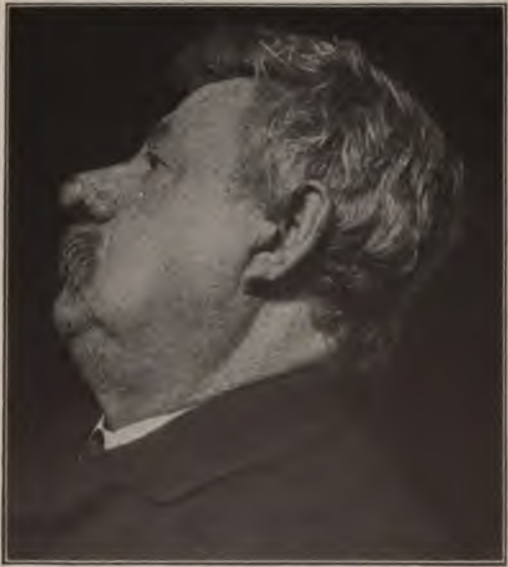

FIG. 45.—SAME SUBJECT AS FIG. 42. Side view, one week after the second operation.

spaces. Their vitality is low, and unless the pedicle is very broad, they are likely to slough. Therefore it is advisable not to undermine them too extensively.

The results of this plastic surgery are very satisfactory (Figs. 44 and 45). In some cases, if the quality of the skin is too poor, it is better to shave off all of the tissue down to the cartilage and to cover the wound with skin grafts.

Hypertrophy of the Tonsil and other Lymphoid Structures in the Naso-pharynx and Pharynx.—The faucial tonsil is frequently enlarged, especially in children, either as a sequence of repeated attacks of tonsillitis or of some other infectious disease, such as scarlet fever, diphtheria, or measles. In children hypertrophy of the tonsils is frequently associated with hypertrophy of the lymphoid tissue in the naso-pharynx, commonly called adenoids, with hypertrophy of the lymphoid tissue at the base of the tongue, the so-called lingual tonsils, and enlargement of the cervical lymphatic glands.

Symptoms produced by tonsillar hypertrophy may be very slight, or the enlargement may be sufficient to interfere with normal swallowing and to favor and make more severe attacks of acute tonsillitis. Adenoids often obstruct the posterior nares to such an extent that the patient breathes through his mouth when asleep, and sometimes during the day as well. For these reasons, surgical treatment is frequently indicated.

Diagnosis.—The diagnosis of hypertrophy of the tonsils is made by direct inspection. If one can see them during a period of acute inflammation, as well as in the intervals between such attacks, he can best judge of the necessity for their removal.

The diagnosis of hypertrophy of the lingual tonsil is made from the image reflected in a throat mirror.

The diagnosis of adenoids is made from the image reflected in a rhinoscopic mirror, when this can be obtained. It can also be made by palpation with the forefinger, and can be assumed from persistent mouth breathing, especially if the anterior nares are not obstructed. There is also an alteration in the sound of the voice, and a postnasal catarrh. In extreme cases the facial expression is altered. Partial deafness may result.

Treatment.—Tonsilectomy is the term applied to the removal of a hypertrophic tonsil. The ancient practise of destroying a portion of such a tonsil by the cautery, or merely excising the projecting portion, has largely yielded its place to a complete removal of the tonsil. This may be done under a local or a general anesthetic. The choice depends more on the character of the individual than on the condition of the tonsils. Those called for the first time to operate upon a young child will do well to employ a general anesthetic.

The mouth is opened, a mouth gag inserted, the tonsil seized with a slightly curved forceps having two or three prongs, and lifted from its bed. It may then be cut off with a tonsillotome, or dissected with scissors or a knife. If the latter method is chosen, it is only necessary to divide the mucous membrane; the

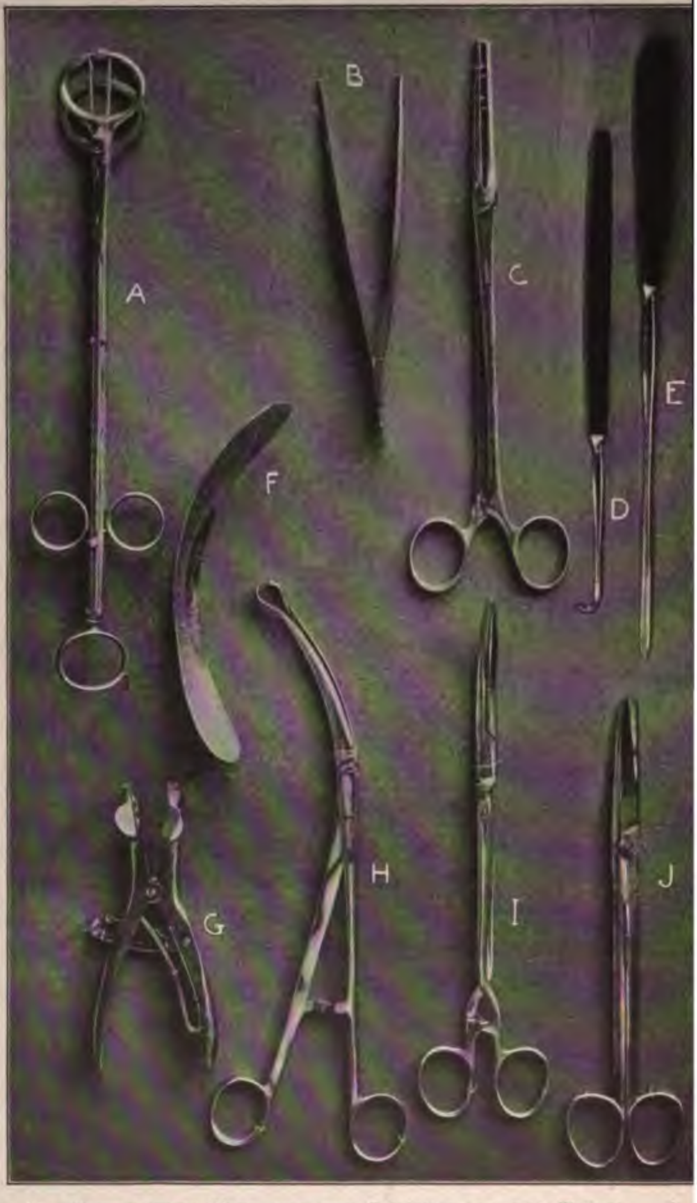

FIG. 46.—INSTRUMENTS USED FOR THE REMOVAL OF THE TONSIL. *A*, tome (this instrument is not used by many operators); *B*, mouse-tooth *C*, sponge holder, of which several should be at hand; *D, E*, blunt pointed *F*, tongue depressor; *G*, mouth gag; *H*, tonsil forceps; *I*, long curved *J*, long curved scissors.

tonsil can then be shelled from its bed by blunt dissection with the finger or a suitable instrument. In this manner the whole tonsil can be removed more perfectly than with a tonsillotome (Fig. 46).

If a local anesthetic is decided upon, the mucous membrane should be anesthetized by the application of a strong solution of cocain or stovain, ten or twenty per cent. There is less danger of poisoning if the anesthetic is applied upon a swab rather than in the form of a spray, but the swab should not be so wet as to allow the solution to trickle down the throat. Another good plan is to inject a few drops of a ten per cent solution of stovain in adrenalin, 1:2,000, into the tissues before beginning the dissection.

Hemorrhage following the removal of the tonsil is free, but usually subsides promptly. It is well to have at hand small sponges in curved clamps, which can be squeezed out of an adrenalin solution and pressed firmly against the bleeding surface. An astringent gargle is also serviceable. The patient should gargle the throat every few hours with iced Dobell's solution somewhat diluted. In most cases the pain which results is surprisingly slight, considering the extent of raw surface which results from this operation.

Hypertrophy of the lingual tonsil, giving rise to persistent cough or husky speech, may require operation. The excess of tissue can be removed with a galvanocautery or a specially constructed tonsillotome.

TREATMENT OF ADENOIDS.—Although adenoids tend to atrophy about the period of puberty, it is unwise to wait for their spontaneous disappearance, if they give rise to definite symptoms as described above. They should be removed by operation, preferably under a general anesthetic, although the postnasal space is readily anesthetized by a ten per cent solution of cocain in a 1:2,000 solution of adrenalin chlorid, applied on cotton wound on a bent probe.

If the child is chloroformed, it may lie with its head lower than its shoulders, or not, according to the operator's preference. In any case, a mouth gag is inserted and the adenoids are removed either with a specially curved curette or with a pair of forceps, or, as many prefer, with the finger nail (Fig. 47).

Following operation, the nose and throat should be frequ
sprayed with a diluted Dobell's solution, or some other dilute
infectant.

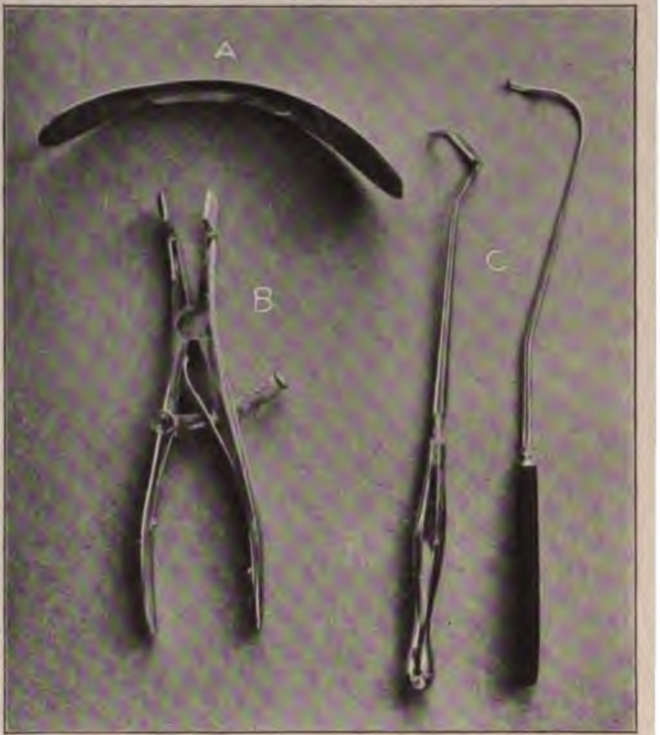

Fig. 47.—Instruments Used for the Removal of Adenoids. *A*, tong
pressor; *B*, mouth gag; *C*, adenoid curettes.

Epulis.—A growth which resembles a papilloma in ap
ance, but which is much denser, is called an epulis. It us
springs from the gum, along the outer side of the molar teeth.
it grows it takes on the shape of the space in which it lies,
therefore appears to have a broad attachment. When it is l
up from the mucous membrane it will often be seen to hav
extremely narrow pedicle. It is a dense hard tumor, covered
mucous membrane having a normal appearance.

An epulis grows slowly, and without pain, but it shoul
thoroughly removed because of its constant tendency to inc
in size, and also because in structure it closely resembles a spi
cell sarcoma. If the growing base of the tumor in the mu

membrane is excised, it is not likely to recur. The specimen should in all cases be examined microscopically.

Otoliths.—Calcareous bodies, called otoliths, often form in the fatty portion of the ear. They are similar in character to the deposits which are found elsewhere in the body in gouty individuals. In the ear these discrete nodules may be so large as to be noticeable and to annoy the patient. They are easily removed through small incisions.

Osteoma, or Exostosis.—This is a benign tumor, being a simple outgrowth of bone. It is easily recognized as having the consistence of bone, to which it is firmly attached. It is covered by normal skin, fat, etc. Such a tumor is very rare in the face (Fig. 48). It is commoner in the skull. If it is decided to remove it, the skin and other parts should be divided and reflected so as to expose the exostosis. This should be chiseled away, together with the periosteum which covers it, as the possibility of recurrence

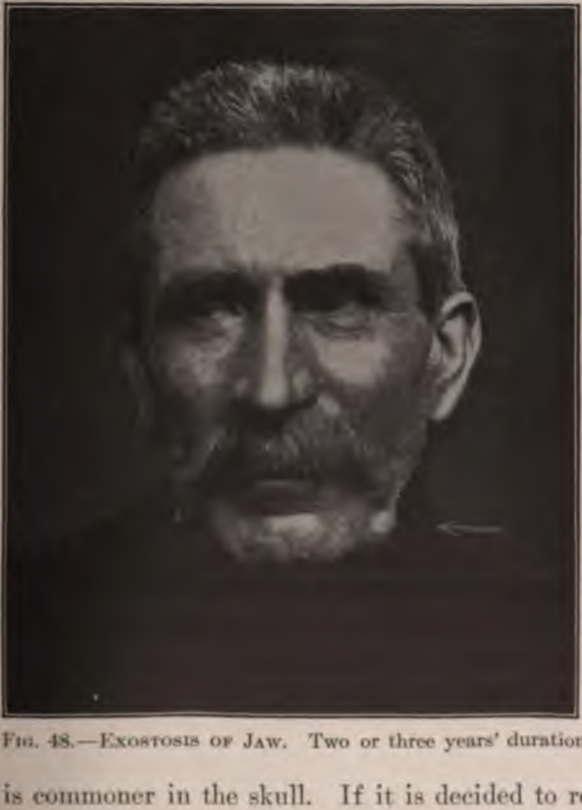

FIG. 48.—EXOSTOSIS OF JAW. Two or three years' duration.

should be borne in mind. While this operation takes only a minutes, it is difficult to anesthetize bone. Therefore, durin chiseling the patient's sensibilities should be benumbed by ch form of nitrous oxid gas, or, if preferred, the whole oper may be performed under a general anesthetic. Such tumors sh be examined microscopically.

Spur.—An exostosis, or a cartilaginous tumor projecting the floor or septum of the nose and covered with normal mu membrane, is called a spur. If of sufficient size to interfere normal breathing, it should be removed with a blunt-pointed the parts having been first anesthetized by the application o cain or stovain upon a cotton swab. Bleeding may be contr by adrenalin, or by the tip of a galvanocautery, an instru which is utilized by some for the removal of the spur.

Deviation of the nasal septum is considered on page 10

MALIGNANT TUMORS

Epithelioma.—An epithelioma may develop in any po of the epithelium covering the head or lining its cavities. common at the mucocutaneous junctions of the eyes, ears, and mouth (Fig. 49).

Its origin, like that of malignant tumors in all situatio the body, is sometimes apparently due to a wound or to a continued irritation, but often such a provoking cause seems ing. Sometimes a wart or mole which has remained of essent the same size for years will begin to grow rapidly, and i removed will develop characteristics of a malignant tumor. other cases the tumor starts as an ulcer almost from the begin

It is in the class of cases in which a simple wart or mol sumes malignant development that surgery has an important to play. A patient may have noticed such a localized thick of the epithelium as is shown in Figures 50 and 51 for Gradually the cells begin to multiply and the tumor increa little in size. This should inevitably be the sign for removal o growth. At this stage it has not begun to infiltrate the skin. has it extended into the deeper tissues. Hence a radical cur be effected by the removal of the tumor without any of the rounding tissues. Such a simple operation can be performed few minutes under local anesthesia, and need not be followed by any permanent scar. On this account a patient will readily consent to the operation.

While it is probable that many of these hitherto benign tumors will never become malignant, it is certain that some of them will do so, and in any event the operation frees the patient of an annoying blemish. Those that develop into malignant growths infiltrate the skin and ulcerate in the older portions, and gradually assume the usual characteristics of carcinoma of the surface with an elevated growing margin, usually of an irregular

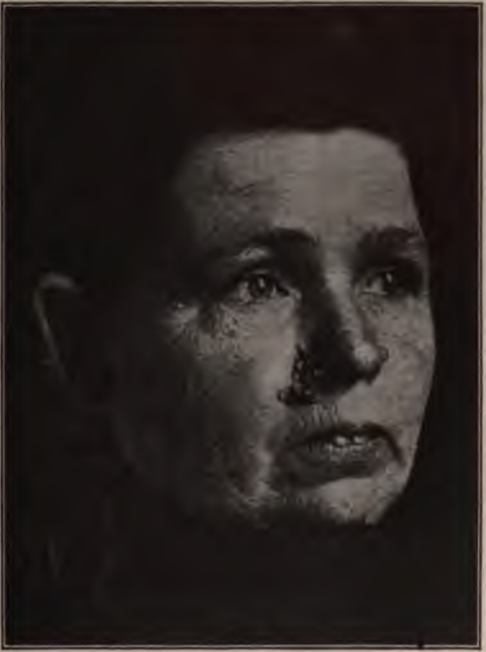

FIG. 49.—EPITHELIOMA OF FACE NEAR NOSE. Duration six years; slight ulceration.

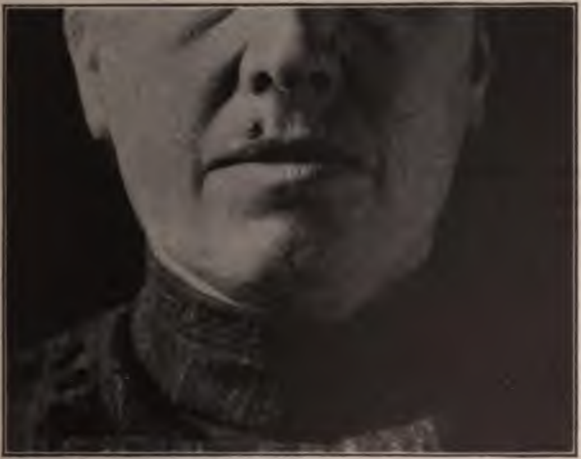

FIG. 50.—EPITHELIOMA OF THE LIP DEVELOPING IN A SOFT WART WHICH HAD EXISTED SINCE CHILDHOOD. New growth noticed nine months previous. Patient aged fifty-six years. A similar wart on nose has recently shown increased growth.

character. But even at this stage epithelioma of the face of rapid growth, and a year or so may elapse before the reaches the diameter of an inch. This is equally true wheth

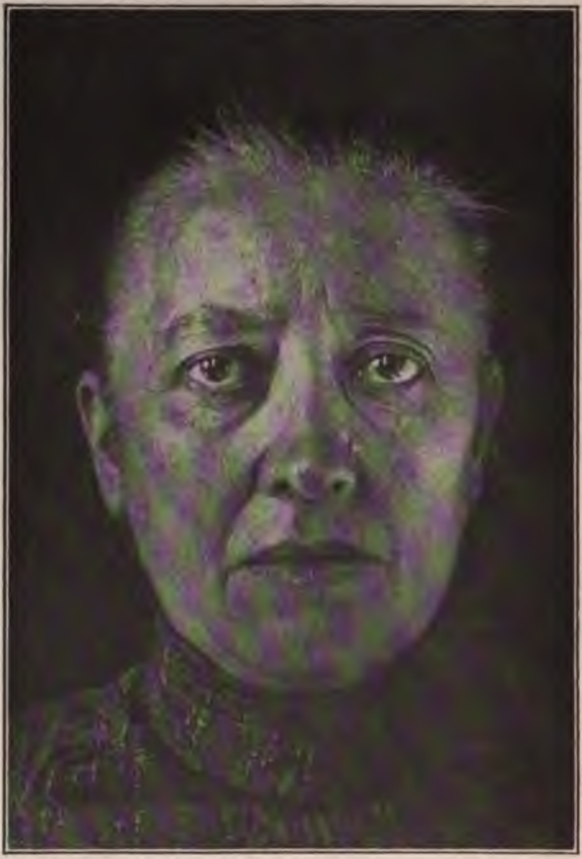

Fig. 51.—Same Subject as Fig. 50, Three Months after Removal of t thelioma of Lip. The scar could only be seen by close inspection; on advantages of early operation.

tumor is at first of the papillomatous type (Fig. 52), or wl it early infiltrates the skin and ulcerates (Fig. 53).

Epithelioma of the face in some individuals progres slowly that the patient will live for years, the tumor gra eating away more and more of the skin and suffering in it turn from ulcerative processes until possibly the skin of ha face is in this manner disintegrated. Such epithelioma is l as rodent ulcer.

DIAGNOSIS.—The appearance of a well-developed epithelioma is characteristic. First there is the very hard infiltration of the skin with the cancer cells. This raises the level of the skin affected above that of the normal surrounding skin. The blood-vessels in the skin involved, and in that adjacent to the new growth, are often dilated. As induration extends, the blood-supply may be shut off from the older portions of the growth and ulceration result. The discharge from the surface of such an ulcer often has a gangrenous odor. The regional lymph-glands may be swollen and hard. This may be the result of metastasis or of the absorption of septic products if an ulcer exists. As a diagnostic sign of cancer it has therefore a greater value when the skin is unbroken than it has after an ulcer forms. The late diagnosis is of little value to the patient. The early diagnosis is life-saving.

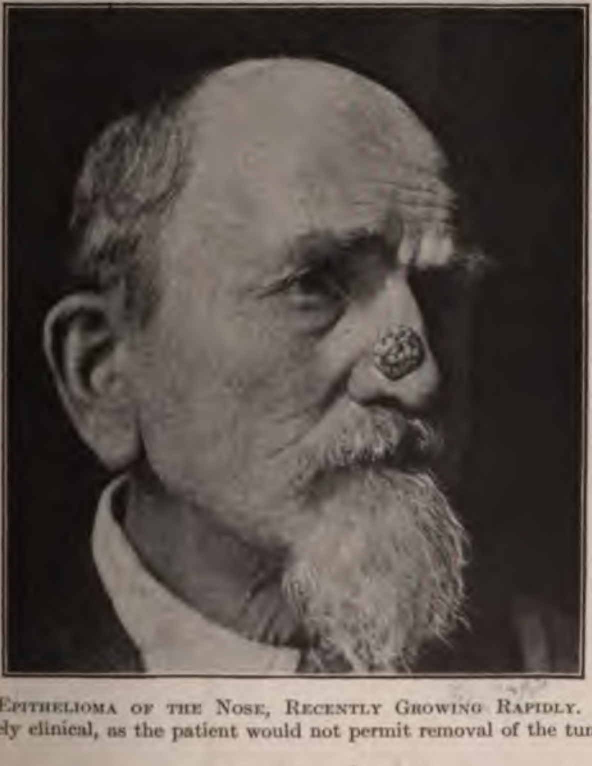

FIG. 52.—EPITHELIOMA OF THE NOSE, RECENTLY GROWING RAPIDLY. Diagnosis merely clinical, as the patient would not permit removal of the tumor.

A beginning epithelioma may be mistaken for a wart or papilloma (Fig. 54). If there is any doubt a microscopic examination

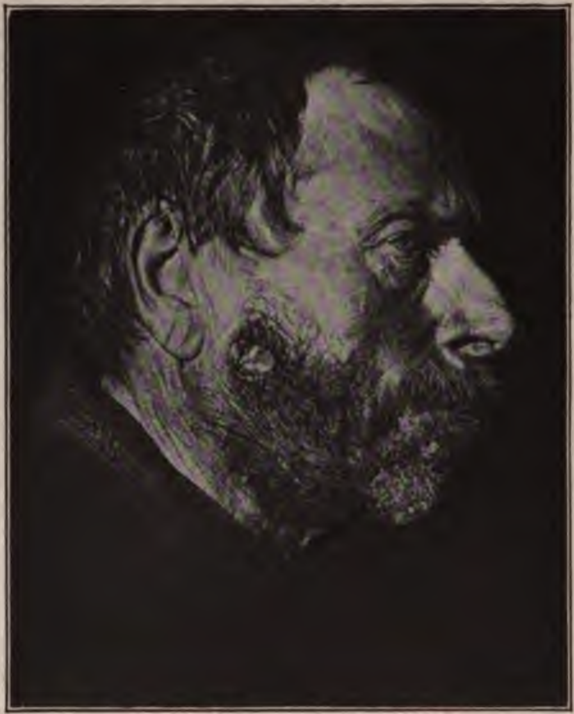

FIG. 53.—EPITHELIOMA OF THE CHEEK, EXISTING TWO YEARS IN A MAN A
SEVENTY-TWO.

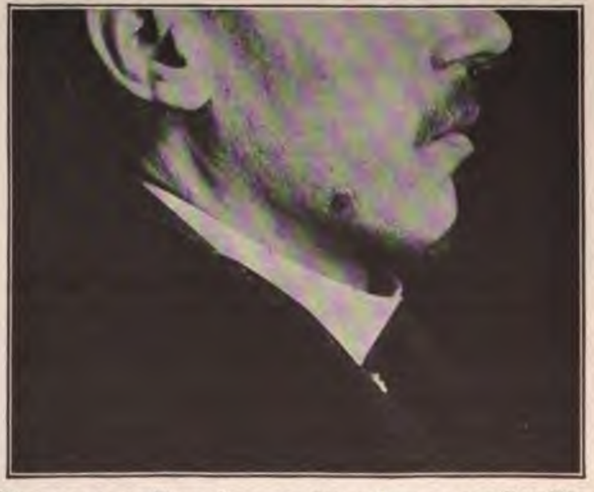

FIG. 54.—EPITHELIOMA OF FACE; SUPPOSED WART SNIPPED OFF FIVE WEEKS
THIS PHOTOGRAPH WAS TAKEN. Compare Figure 36, page 77.

should be made or the tumor should be removed. In fact, every such tumor which shows a tendency to grow, should be promptly excised. When this is done at an early stage, before the tumor begins to infiltrate the skin, it is unnecessary to sacrifice any of the surrounding skin, and no disfiguring scar follows. Hence a patient is more likely to submit to operation at this early stage, which is sometimes spoken of as the precancerous stage. Microscopical examination of the removed tissue will sometimes show that this term "precancerous" is not justified (see Figs. 57, 58, and 59, and the description of them on p. 98).

Epithelioma of the Scalp.—The early appearance of epithelioma in the scalp is that of a slightly elevated irregular tumor, the surface of which is redder in places than the normal scalp, and which is partly covered by the crusts which are prone to form upon the scalp whenever it is irritated (Fig. 55).

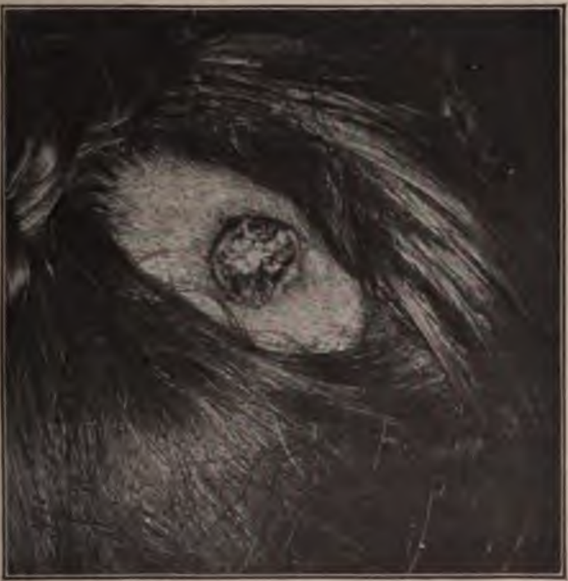

FIG. 55.—EPITHELIOMA OF THE SCALP OCCURRING IN A WOMAN AGED FIFTY-EIGHT.

Illustrations showing different types of early epithelioma of the face have been given in the preceding pages.

Epithelioma of the Lip.—One type of early epithelioma of the lip is shown in Figure 56, the ulcer of which was said to have existed only four weeks. Another case in which ulceration was of the

most superficial character, although the tumor had lasted one y
is shown in Figure 60, page 101. This is a favorite seat for epi
lioma. It often follows long-continued smoking of a clay p
arising at the point where the hot, rough stem of the pipe
rested upon the lower lip. It begins as a slight induration w
the patient scar
notices until li
scales form upon
surface or a very s
low ulceration
duces slight cru
These from time
time are picked of
fall off, but the
coriation fails to l
In the meantime
induration spr
slightly or creeps
the deep tissues,
for many months, by reason of its limited extent and lack of p
the patient may look upon the lesion as unimportant.

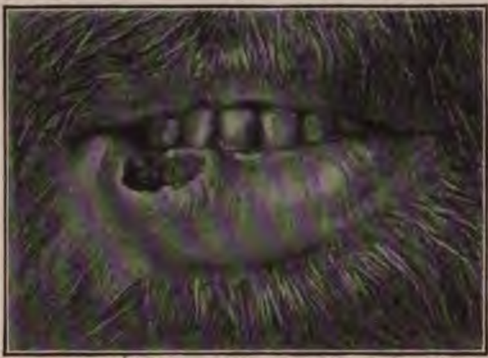

FIG. 56.—EPITHELIOMA OF THE LIP, SAID TO BE OF FOUR WEEKS' DURATION. Patient aged forty-two years.

Epithelioma of the Tongue.—Early appearances of epitheli
of the tongue are shown in Figures 57, 58, and 59. Attentio
especially called to the two types of lesion there shown—nam
the milky white patches of leucoplakia which had existed for
eral years, and the elevated, warty nodules which had existed
some months at least. In neither of these had the epithelial
begun to grow downward at the time the drawing was made.
of the mature cancerous growth for which this tongue was
moved came from an ulcer on its left margin, which does not s
in this drawing.

The chief possibility of error in the early diagnosis of
thelioma of the face lies in mistaking for it the primary lesio
syphilis. As already pointed out (page 60) the primary
upon the thick epithelial layer of the skin or even of the lip
tongue has quite a different appearance from the primary sore u
the more delicate epithelium of the head of the penis.

Besides illustrating the early appearance of epithelioma of
tongue, Figures 57 to 59 show how misleading the negative m

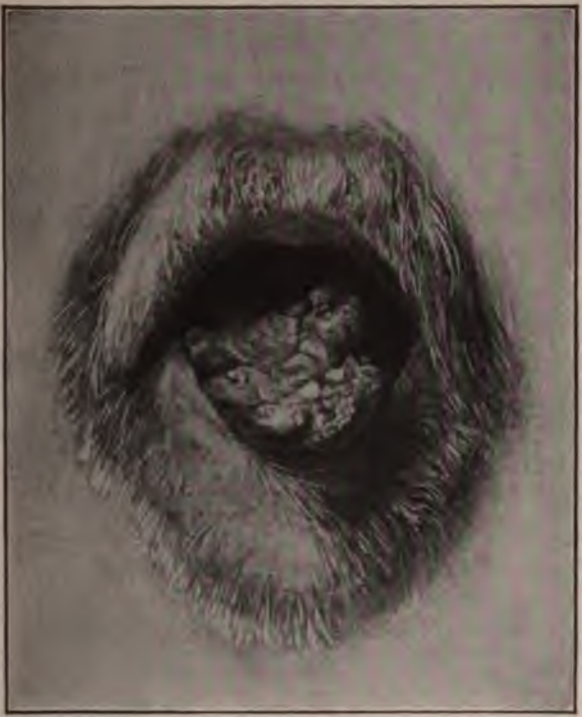

FIG. 57.—EPITHELIOMA OF THE TONGUE, SHOWING MILKY WHITE PATCHES OF LEUCOPLAKIA, AND PAPILLOMATOUS GROWTHS, ESPECIALLY IN THE MEDIAN LINE OF THE TONGUE. These were shown by microscopic examination to be not epithelioma, the only epithelioma being along the left border and in the center of the tongue.

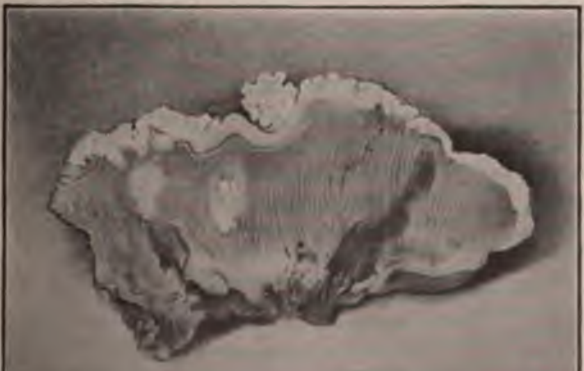

FIG. 58.—LONGITUDINAL SECTION OF TONGUE IN THE MEDIAN LINE, SHOWING TWO SMALL "ISLANDS" OF EPITHELIOMA IN ITS POSTERIOR PORTION. Same subject as Fig. 57.

scopic examination of small sections of tissue may be. Such s tions were twice removed from the center of this tongue, and w correctly pronounced to be not epitheliomatous. A third secti was then taken from the left lateral margin, and was found to p sent the usual appearances of epithelioma.

TREATMENT.—The best treatment of a patient who has an e thelioma in an early stage is a complete removal of the tum together with a reasona margin of healthy tissue on sides of it and beneath Just how wide this mar should be cannot be stated a general rule. If the tis is lax and abundant, it is v to make the incision one-th of an inch away from the ible edge of the tumor. If surrounding skin is less f ible, or if the tumor is so s ated that a scar will be v prominent, one is perhaps ju fied in removing a narro zone of healthy tissue with the tumor. This is more likely to the case if the growth of the tumor is almost wholly upward, infiltration has not yet taken place.

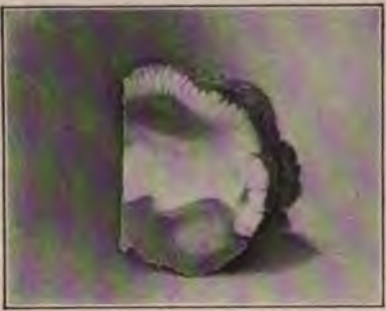

FIG. 59.—TRANSVERSE SECTION OF THE TONGUE THROUGH THE ANTERIOR "ISLAND" OF EPITHELIOMA SHOWN IN FIG. 58. It will be observed that the whole of this epithelial growth was from the lateral margin of the tongue.

When the tumor has been removed, hemorrhage is contro by pressure or ligation of vessels, and the surgeon must consi the best manner of covering the defect. In many cases the wo may be closed by direct suture if the surrounding skin is loose from the deep fascia. In other cases a plastic operation, or s grafting, or a combination of the two methods, will give the results.

The regional lymph-glands should be examined. If they palpably enlarged the spaces in which they lie should be t oughly freed by dissection of glands and the connective tissue which they lie. This requires general anesthesia. Some surge advocate it as a routine measure in all cases, whether the gla are palpable or not. In such an early stage of the disease a shown in Figures 54 and 60, it hardly seems warrantable to ad much to the risk of operation, when the prognosis is so good without the more extensive dissection. If the glands are palpably enlarged, prognosis is much more grave, but is still sufficiently good to make a complete removal of glands and tumor desirable. Every tumor of the skin which is removed should be examined microscopically.

The removal of epithelioma of the lower lip is accomplished as follows: The lower lip is shaved and cleansed thoroughly with soap and hot water. The teeth are brushed and the mouth rinsed with a dilute antiseptic. The lip is wiped with cotton wet with a stronger antiseptic solution. An assistant then seizes the lip at its right and left ends, between his thumb and fingers, standing behind the patient and putting the thumbs inside the patient's mouth. This compresses the inferior coronary and inferior labial arteries and absolutely controls hemorrhage. The operator then injects from twenty to forty minims of a one per cent solution of cocain along the lines of incision, and cuts a V-shaped section from the lip, the incisions for the purpose (Fig. 61) passing through the whole thickness of the lip. They start in the free border at least one-third of an inch from the visible margin of the growth. The V should extend well down on the chin. This reduces the amount of deformity as well as guards against recurrence. The wound is sutured with fine black silk (Fig. 62). If the external stitches include all of the tissues except the mucous mem-

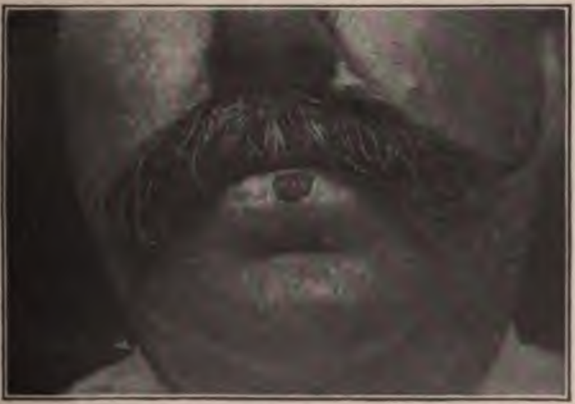

FIG. 60.—EPITHELIOMA OF LOWER LIP. Duration one year. Patient ready for operation.

brane, apposition will be so perfect that the mucous membrane need not be sutured. This saves a rather difficult extraction of sutures from within the mouth. A narrow strip of gauze should be placed over the wound and tension relieved by a strip of adhesive plaster from one side of the chin to the other. One-third of the lower lip may be removed with the certainty that no permanent deformity will result. If the tumor is situated very near the angle of the mouth, it may be necessary to extend the incision outward through the cheek to give greater freedom to the remnant of the lower lip.

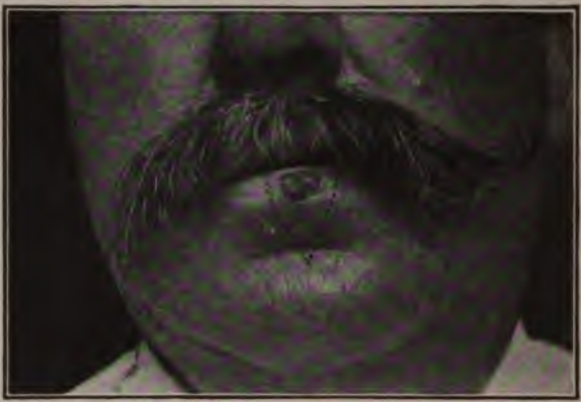

FIG. 61.—EPITHELIOMA OF LOWER LIP, SHOWING THE LINE OF INCISIONS.

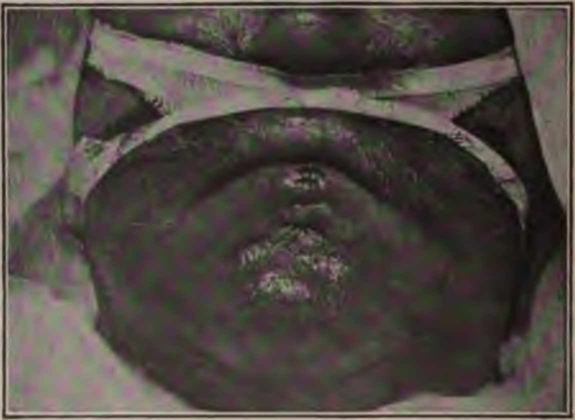

FIG. 62.—EPITHELIOMA OF LOWER LIP. After excision of the V-shaped piece, the gap in the lip is closed by sutures which need not penetrate the mucous membrane.

Epithelioma of the tongue may occur upon the dorsum of the tongue, or along the edge, or in the vicinity of the frenum. As the early removal of this tumor has a favorable prognosis, it is extremely important that it should be recognized before the growth is extensive, and before the lymphatic glands in the neck have become involved. Unfortunately patients are indifferent to small sores upon the tongue until they give rise to considerable pain. The saliva soaks off any discharge, so that the sore has not the striking appearance of an epithelioma of the skin with its covering of crusts. For this reason, most physicians fail to recognize epithelioma of the tongue as soon as they should do so.

The disease first appears in one of three ways: There may be a white, wartlike growth, without ulceration, and with a scarcely noticeable induration at the base. Second, there may be a flat, slightly raised, smooth, red tumor which feels like a bit of gristle in the surface of the tongue. At a later stage this will ulcerate. Third, an old area of leucoplakia which possibly has existed for years will take on a malignant growth in some portion, showing distinct elevation, and then some induration at the base. This, too, will ulcerate later (Figs. 57–59).

If an epithelioma of the tongue is recognized at an early stage, before ulceration sets in, the resection of the tumor with a safe zone of healthy tissue around it is a thoroughly safe operation. Some surgeons advocate the removal of the fascial tissue containing lymph glands from the neck, although at this early stage the glands which are removed can rarely be demonstrated to contain cancer cells. If the disease is allowed to progress until ulceration has taken place, and there is marked infiltration of the tongue, and the lymphatic glands of the neck are palpably enlarged, removal of one-half, or even the whole, tongue, and an extensive dissection in the neck gives slight hope of permanent cure. Radical cure, under such circumstances, is achieved in probably not more than twenty-five per cent of the cases. The indication is, therefore, strongly in favor of early removal at a time when the operation may be performed under cocain if necessary, and most of the tongue may be preserved. On account of its free circulation and great flexibility the tongue is an excellent subject for plastic work.

Methods of Treatment other than Excision.—Epithelioma of the face may be removed by chemical caustics or other agencies capable of destroying tissue cells, such as the X-ray. That ma cures have been effected by these means, every unprejudiced server readily admits. They are generally considered to be l certain methods of removing the growth. They require a lo period to effect their object, and evidence is lacking to show tl recurrence is less likely to occur when a tumor has been destroy by caustics than when it has been removed with a knife. Inde from what we know of the structure of the skin and of the nat of tumor growth, it is probable that recurrence is less likely wl a zone of healthy tissue is removed with the tumor than wl the tumor cells are killed *in situ,* so to speak.

Methods other than excision are therefore to be adopted o when the patient refuses to allow the removal of the tumor means of the knife. One of the best caustics to employ is a per cent solution of arsenious acid in alcohol. A few drops hydrochloric acid increase its solubility. This may be painted with a camel's-hair brush every second day. This is a clea method of application than the usual one of arsenic paste.

In using the X-ray for the destruction of an epithelioma, surrounding skin should be protected, and the length of expos distance from the tube, etc., should be carefully noted at e treatment. In beginning treatment it is well to err on the s of safety, so that the exposure should be brief, and three d should elapse between treatments. Later, when the full effect the X-ray can be estimated, treatments may be increased in se ity and in frequency. The details of this form of treatment h been frequently published in magazines and monographs.

Sarcoma.—Sarcoma of the head, while not very common, curs with sufficient frequency to make the differential diagnosis tween it and benign growths of great importance. The diagn is often a difficult one in this region on account of the freque here of sebaceous and dermoid cysts and of gummata and ot inflammatory lesions. Two essential points shown by a ma nant but not by a benign tumor, are the lack of a distinct bou ary and the presence of enlarged blood-vessels in the vicinity the tumor. Both of these signs were present in the case sh in Figure 63. This tumor had been growing rapidly for s months, but without pain or cerebral symptoms. It had b diagnosed as a sebaceous cyst by two doctors, and an immed

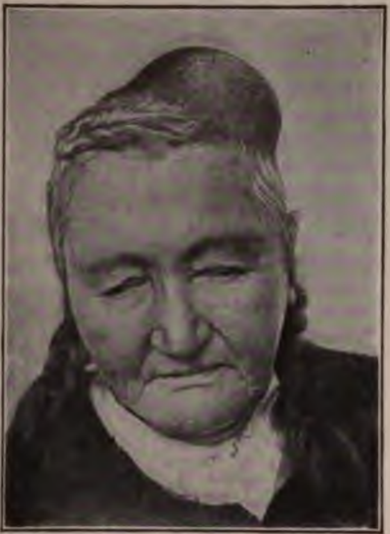

FIG. 63.—TUMOR OF HEAD—EXTRADURAL—CLASSIFIED ON PATHOLOGICAL EXAMINATION AS AN ABERRANT THYROID.

office operation advised and a speedy cure promised. Another doctor had affirmed that it was cancerous and that its removal would prove fatal. The surgeon in whose care the patient finally placed herself removed a section of the tumor for examination. Upon learning that the tumor was not sarcoma, and having found it to be encapsulated, he later removed it without difficulty, but with so great a loss of blood that the patient did not rally. It was extradural, but had eroded a circular area of the skull about two inches in diameter. The substance of the tumor itself was on gross and microscopic examination like the tissue of a rapidly hypertrophying thyroid gland.

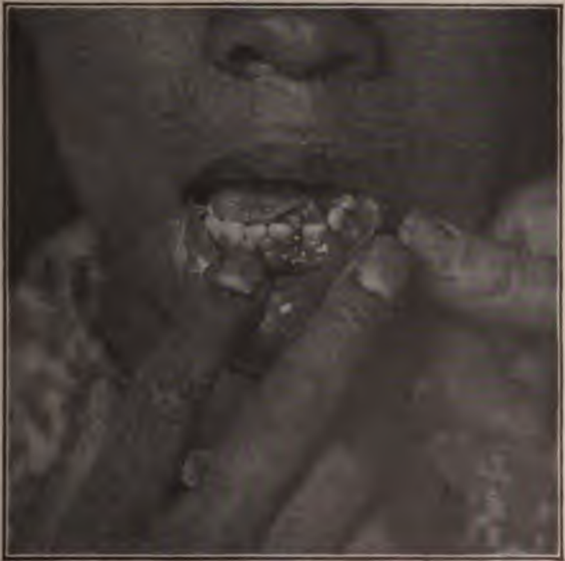

FIG. 64.—ANGIOSARCOMA OF THE LOWER JAW OF A COLORED GIRL, AGED TWENTY-THREE. The tumor had been noticed for one month.

Sarcoma of the face is far less common than epithelioma. Sometimes a small and apparently innocent tumor of the skin will prove upon microscopical examination to be sarcoma.

Angiosarcoma of the jaw occurs, and has a marked diagnostic importance because in its early stages (Fig. 64) it may be mistaken for the spongy condition of the gums due to scrofula. The history of the disease and the general condition of the patient will usually suffice for a correct diagnosis. In doubtful cases a microscopical examination of a fragment of the tumor should be made. Attention to the diet, and the use of an astringent mouth wash which will speedily improve scrofulous gums will, of course, have no effect upon the development of a sarcoma.

Parotid Tumors.—In the region of the angle of the jaw malignant tumors of varied histological structure arise in connection with the parotid gland: carcinoma, sarcoma, chondroma, myxoma,

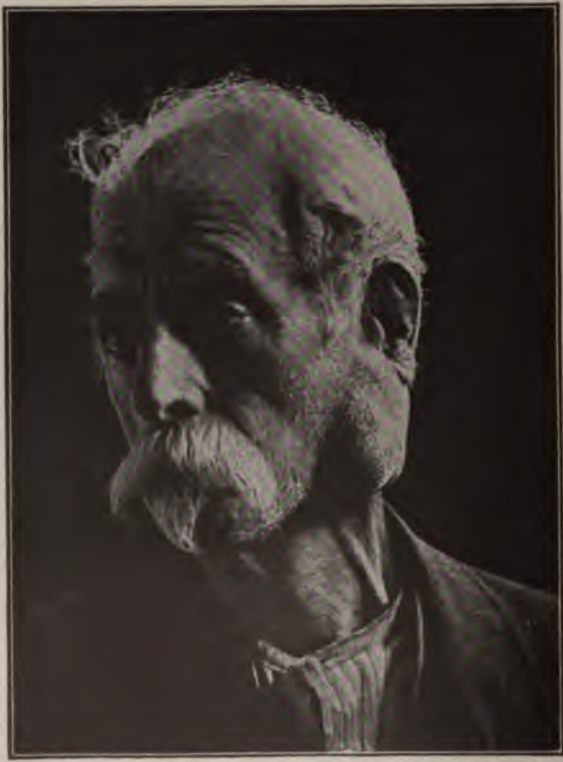

FIG. 65.—TUMOR OF PAROTID GLAND, SAID TO HAVE EXISTED TEN OR TWELVE YEARS. The skin was not attached, and the tumor was movable in all directions.

and a combination in one tumor of the various structures which these names imply, may develop in this situation and give rise to a rounded, hard mass, usually composed of more than one lobule, which grows slowly or rapidly and often reaches the size of a small egg before the patient seeks surgical aid (Fig. 65). Such a tumor, like malignant tumors of a parenchymatous nature elsewhere in the body, is most often seen in middle life or later. If the conditions warrant it, no time should be lost after the diagnosis is made in accomplishing its thorough removal. As the tumor springs from the gland it is closely attached to it, but is movable with the gland upon the skin and deeper tissues. As it grows it infiltrates the surrounding tissues so that this mobility is soon lost. It may be distinguished from an inflammatory process by the history of its slow development, by its hardness, and by its situation in the parotid. It is most likely to be confounded with tuberculosis or syphilis of the cervical lymphatic glands. These are usually situated below the angle of the jaw, but they may also extend above it. In affections of the lymphatic glands careful examination will almost always show that two or more distinct glands are involved; whereas if a malignant tumor has nodules they can be shown to be connected, being invariably part of the same growth, except, of course, in case of secondary lymphatic involvement. Furthermore, tubercular and syphilitic glands which have attained any considerable size fall to pieces internally so that fluctuation can usually be made out in them.

Cancer of Tonsil.—Tumors of the tonsil of a malignant character are on the border-line histologically between carcinoma and sarcoma. They may be easily mistaken for a chronic hypertrophy of the tonsil, and if there is the slightest question a large section of the tumor should be taken for examination by a pathologist. Even then the diagnosis may not be an absolute one, and the decision between the risk of allowing the tumor to remain and the risk of an operation for its radical removal is one of the most difficult in surgery. If a presumably hypertrophied tonsil is amputated by means of the tonsillotome and subsequently recurs, this fact, even more than the result of histological examination, will incline the surgeon to perform a more radical operation for removal of the tumor. These tumors affect the deeper structures, and do not give rise to ulceration until a late stage is reached.

Their treatment is beyond the range of minor surgery, but subject is mentioned here on account of diagnostic importance.

ACQUIRED DEFORMITIES

Cicatrices.—Cicatricial contractions in the vicinity of eye may so pull upon the lids as to cause their partial eversion prevent the tears from flowing through the tear-duct in a natu manner. To relieve this in certain cases plastic operations n be performed with more or less success, and even where the ey has been partially destroyed a substitute may be found in a of skin taken from the adjacent skin.

Cicatricial deformity of the lip from a burn of the neck shown in Figure 87 on page 148.

Nasal Deformities.—Deformities of the nose are am the commonest disfigurements. When hereditary syphilis atta the nose of an infant or child, or contracted syphilis the of an adult, it often destroys the cartilage to such an ext that there is a hollowing out where normally the bones cartilage should be prominent. The result is often calle saddle-nose.

TREATMENT.—Numerous attempts have been made to c these deformities in later life by inserting some rigid substanc make good the lack of bony support. Any support which is fi to the bones of the face will soon fail, because of the soften of the bones upon which it rests, and its removal will be necess A far better plan, therefore, when the tip of the nose is not stroyed, is to insert beneath the skin a boat-shaped piece of ce loid, the upper surface of which is straight or slightly roun while the under surface is shaped to fit the sunken bridge of nose. If the incision made at the side of the nose for the inser of the celluloid is a small one and made obliquely through the s the resulting scar will be quite invisible. Necrosis of bone will be produced as the periosteum is not disturbed. Before the ce loid is inserted, a bed is made for its reception by separating skin from the cartilage with an appropriate instrument, a favo one being made like a minute ax upon a very long handle. bed should be so prepared that the celluloid may lie in it eas and no attempt should be made to hold it in position by a banc or plaster. If the result is to be satisfactory, the support must rest easily in the cavity prepared for it.

Deviation of the Septum of the Nose.—The septum of the nose may be deviated to one side, usually as a result of traumatism. One air-passage may be closed thereby.

TREATMENT.—A number of operations have been proposed to establish free passage of air through both nasal fossæ. The simplest of all is to punch out a large opening in the septum at its most projecting point. The practical result of this is good, but it is a permanent deformity, and as such has not appealed to the minds of either surgeons or patients.

Of the many operations which have been devised to straighten the septum, two may be mentioned as comparatively simple in technic, and likely to yield a good result. A tongue-shaped flap of the whole thickness of the septum may be cut from the convex side. While it is still attached posteriorly, it should be pushed through the opening in the septum until it lies in the other nostril. A hollow rubber cone may be placed in the nostril to prevent the flap from resuming its original position until healing has taken place.

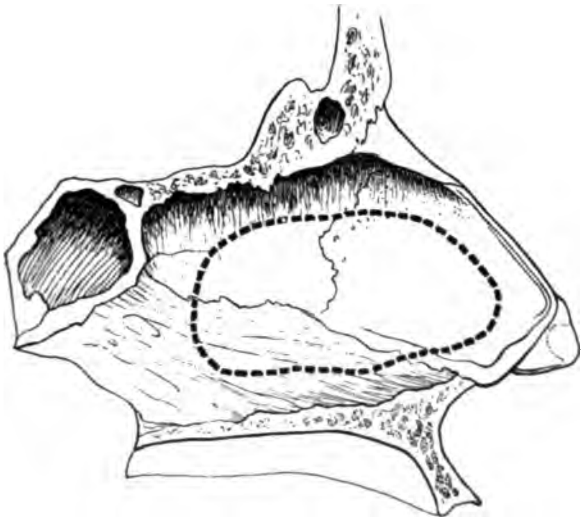

FIG. 66.—DIAGRAM OF THE SEPTUM OF THE NOSE, SHOWING THE PORTION NECESSARY TO RESECT SUBMUCOUSLY TO CURE DEVIATION OF THE SEPTUM.

A newer method is submucous excision. Anesthesia and ischemia are produced by the surface application of cocain and adrenalin for twenty minutes or more. An incision is made the convex side about a third of an inch posterior to the junct of skin and mucous membrane. This incision extends through perichondrium. Through this incision the mucous membrane perichondrium are peeled from the convex surface of the sept The anterior incision is next carried through the cartilage of septum, and the perichondrium is peeled from the concave face of the septum. The denuded portion of cartilage is then cised with a special knife and scissors. It is usually necessar excise with a small chisel a portion of the nasal spine of the s rior maxilla, and a portion of the vomer (Fig. 66). In any e the resection should be continued until the septum hangs stra in the middle line. The incision is closed with two or t sutures. No after treatment is required; or a little gauze be kept in each nostril for forty-eight hours. It is importan preserve both layers of perichondrium, so that a certain am of rigidity may be retained, and in order to avoid subsequent foration of the septum through atrophy.

Elongation of the Uvula.—A catarrh of the naso-pha sometimes leads to enlargement and elongation of the uvula. elongation is a common accompaniment of acute inflammatio the throat, and disappears as soon as the inflammation subsi No treatment of the uvula itself is necessary in such cases. quite another matter when the uvula is chronically so elong that its tip rests constantly on the base of the tongue or reaches to the epiglottis, causing the patient to gag and co particularly when he lies upon his back. The possibility th persistent dry cough is due solely to uvular irritation shoul borne in mind.

Inspection of the throat will show at once whether uvula is long enough to cause irritation. If acute inflam tion is present one should, of course, wait until this has pa over before condoning the uvula, as the elongation may be porary.

Treatment.—When a uvula is elongated and the caus irritative symptoms, it should be shortened by appropriate t ment. This means first of all attention to the general condi of health of which the relaxation of the uvula may be only manifestation. Such general causes are indigestion or cons tion, too much tobacco or alcohol, over-exertion, bad air at work or during sleep, breathing through the mouth, etc.

Astringent gargles and sprays, or the application directly to the uvula of stronger preparations than the patient should handle himself, will sometimes result in a cure. Tannic acid, alum, and the salts of silver are remedies worth trying.

If local remedies and attention to the general health fail to shorten the uvula sufficiently to cause the disappearance of symptoms, a portion of the little organ should be removed. This operation is a simple one, but it is desirable that the excision should be exact, since the removal of too much or too little may subject the operator to a good deal of criticism, especially if some symptoms persist. The uvula should be anesthetized by the application of one per cent cocain on a cotton swab to its anterior and posterior

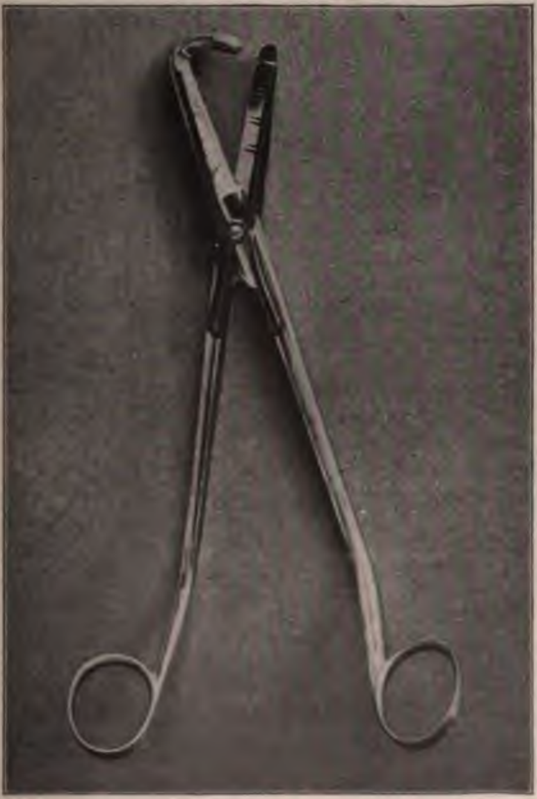

FIG. 67.—SCISSORS FOR AMPUTATION OF THE UVULA.

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surfaces. The tip of the uvula should then be seized with mo tooth forceps and drawn somewhat forward. A sufficient par the organ is then to be cut away with curved scissors. The removed should extend higher posteriorly than in front. By means the blunt appearance of the uvula is avoided, and wound is placed on the posterior surface and so is less affecte swallowing. Unless the uvula is held by forceps during the sec it is likely to slip from the scissors. A special instrument has made for the purpose which combines the action of the for and scissors. It is called an uvula scissors (Fig. 67). If he rhage follows, it is readily controlled by pressure with a swab with a solution of adrenalin, or peroxid of hydrogen, or on the other styptics.

No after-treatment is required other than the use of iced bell's solution as a gargle, or some similar alkaline solution, the avoidance of coarse or seasoned articles of diet for a few

CONGENITAL DEFORMITIES

Harelip and Cleft Palate are common congenital def ties. There may be either one or two clefts of the lip and ant portion of the mouth, but the posterior portion of the hard p and the soft palate develop from right and left halves, so t cleft due to imperfect development is invariably single. I harelip is double its central portion is connected with the i maxillary bone and is attached to the septum of the nose. deformity may be so extreme that even a successful operatio duces a most unsatisfactory result. The opening may be c but the scar and disfigurement which persist are most unsi If, on the other hand, the development of tissue both of the c portion and margins of the clefts has been abundant, it is po to produce something like a normal appearance, even thoug clefts open into the anterior nares. If the cleft is unilatera exists in the lip only (Fig. 68), a perfect result may be obt so that it is scarcely possible in after-years to perceive that a lip existed. The time for operation has been the occasion of dispute among surgeons, but it is now pretty generally ad that a cleft palate should not be operated upon until the c six or eight years old, whereas a better result is obtaine harelip is operated upon in early infancy, say from the third to the sixth month, or even earlier if the cleft in the lip interferes with the proper nutrition of the child or causes deviation of the nasal septum (Fig. 69). Sometimes, when the child cannot nurse from the breast it may take milk from the bottle, or, if not, life may still be preserved by pouring milk into its mouth from a teaspoon, or the feeding may be accomplished by the passage of a soft rubber catheter into the esophagus.

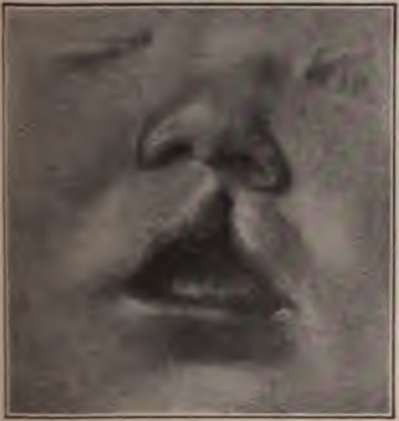


FIG. 68.—HARELIP, THE CLEFT NOT ENTERING THE NOSTRIL. The vermilion of the lip extends into the cleft, but is much narrower there.

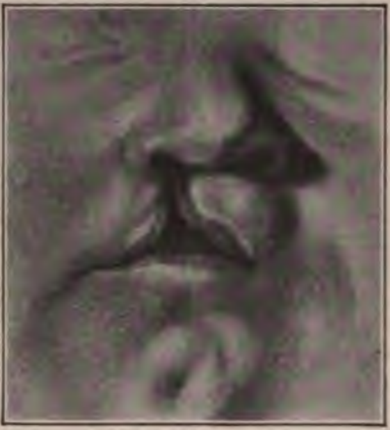


FIG. 69.—HARELIP, THE CLEFT ENTERING THE NOSTRIL. Note the deviation of the septum, even in this comparatively simple case.

TREATMENT.—In operating for harelip it is of the first importance that the vermilion border be accurately approximated, and, secondly, that a slight excess of tissue at the suture-line be provided; otherwise the contraction which follows in every scar will draw the lip upward at the line of suture and a slight notch will result. To overcome this, it has been found best to make an oblique incision through the vermilion portion of the lip and to leave a little fulness at this point. If the power of contraction is overestimated it is very easy to reduce this excess at a later period of life. The edges of the cleft must be pared so that they shall be even, and enough tissue must be removed to make the edges to be sutured equal in thickness to the rest of the lip.

The suturing is very important. Fine black silk is the best material for the purpose. There may be a number of stitches which approximate separately the mucous membrane and the skin. Or fewer stitches may be employed and passed through the whole thickness, or nearly the whole thickness, of the lip. In any case the strain should be evenly distributed upon the stitches. Some operators employ one or two additional stitches set well back from the wound, in order to take the strain off the suture-line. This can, however, be accomplished with less disfigurement by placing a narrow strip of strong gauze, such as bolting silk, across the lip from cheek to cheek, fastening its ends to the cheeks by collodion. Another method is to carry two strips of adhesive plaster from the cheeks to the forehead. These two strips make an X, crossing over the bridge of the nose, and fully relieve tension upon the upper lip.

The stitches should be removed as early as possible, say in three or five days, in order to avoid a prominent scar, but the strain on the lip must be prevented for a longer period by one of the methods mentioned. In infants operation for simple harelip may be done without any anesthetic, or with a very little chloroform.

Cleft of the Lower Lip.—A rare deformity, and one which is always single in the median line, is the cleft of the lower lip (Fig. 70). It is easily cured by a V-shaped excision of the cleft followed by suture (p. 101).

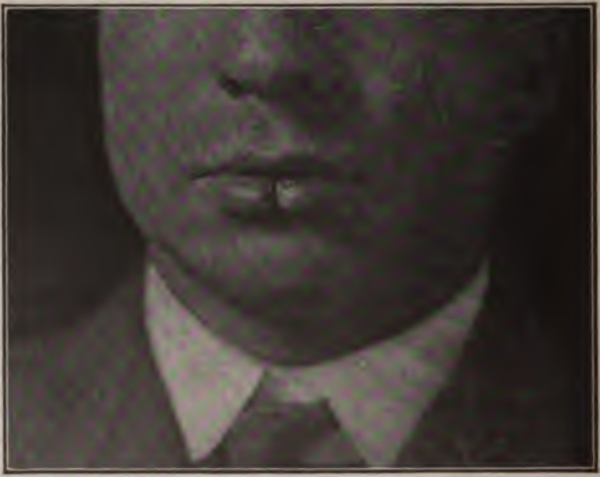


FIG. 70.—CONGENITAL CLEFT OF LOWER LIP.

TREATMENT FOR CLEFT PALATE.—If the cleft in the palate involves only the soft palate, the operation for its relief is very simple. It consists in paring the edges of the cleft and carefully approximating them with many fine black silk sutures. If the cleft extends also into the bony portion and is not too wide, it may be closed by suture of the mucous membrane alone. To make this possible, however, it is necessary to make preliminary incisions about half an inch from the cleft on either side and separate the strips of mucous membrane from the hard palate. These two strips, right and left, may then be sutured in the middle without great tension.

To close a larger cleft a strip of bone and mucous membrane may be chiseled from either side and sutured together in the middle. If this operation is successful, two small clefts remain which can be closed by subsequent operation. The details of these operations will be found in books on major surgery. Complete anesthesia is necessary.

If it is decided to wait some years before operating for cleft palate, a plate of rubber should be fitted and worn. This can be done as soon as the child has double teeth to which the plate can be fastened—generally at two years of age. Such a plate facilitates swallowing and is a great help to the child in its efforts to talk.

Thick Lips.—Persons with very thick lips sometimes become dissatisfied with their appearance and seek surgical aid. An improvement can be accomplished by the removal of an elliptical shaped piece, the incisions for which should lie fully within the vermilion portion of the lip and should run on either side to a very fine point, in order to produce a smooth appearance.

Tongue-tie.—Parents often think their child's tongue is tied if he does not learn to talk as soon as the average child. If the tongue can be protruded beyond the incisor teeth it is sufficiently free for all purposes. If the frenum of the tongue is really short it will pull upon the tip of the tongue and produce a cleft in the tip when an attempt is made to extend the tongue. If this is the case, the tongue should be lifted and the frenum snipped with scissors. The reverse end of the surgical instrument called a grooved director is often made with a notch, so that when one uses it to lift the tongue, the frenum may slip into it and be firmly held while the surgeon makes the necessary division. Backwardness in acquiring speech is, of course, dependent on other causes.

Deformities of the Ear.—The lobe of the ear may be (Fig. 71). A rather commoner deformity is reduplicatio some portion of the auricle (Fig. 72). The occurrence of sin

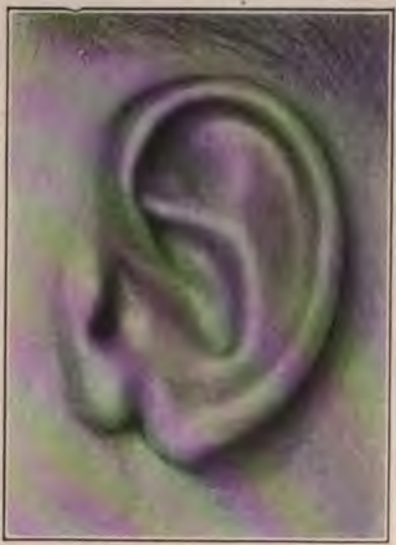


Fig. 71.—Congenital Cleft of Lobe of Auricle.

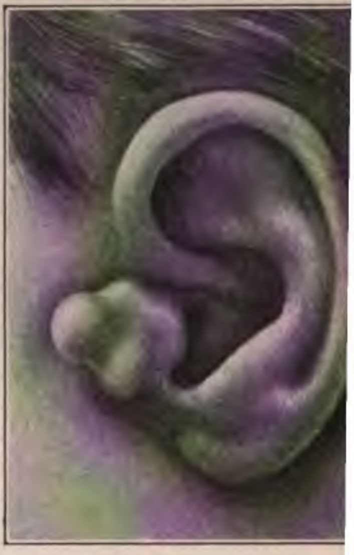


Fig. 72.—Congenital Deformit Ear.

in front of the meatus has been spoken of on page 76. Mar the deformities of the auricle may be remedied by plastic o tions.

SECTION II

AFFECTIONS OF THE NECK

CHAPTER IV

INJURIES AND INFLAMMATIONS OF THE NECK

Contusions.—Contusions of the neck, if serious, are so because of the injury to the deeper structures. They are usually the result of accidental or attempted strangling. The skin of the neck is tough and freely movable, and if it is pressed against any underlying bone, it may escape injury, even though some deeper structure such as the hyoid bone or larynx be broken. An example of this is seen in cases of wheel injury. The wheel of a vehicle, especially if rubber-tired, may pass over the neck and even break one or more of the vertebræ without leaving any mark externally.

Foreign Bodies.—A foreign body, such as a morsel of food or some harder substance, may lodge in the larynx, trachea, or esophagus. (For foreign bodies in mouth and pharynx see page 12.) The symptoms vary all the way from a slight irritation and discomfort on swallowing, to complete strangulation and intense pain, depending on the shape and characteristics of the foreign body and the particular position which it occupies.

TREATMENT.—Even when the symptoms are not alarming the foreign body should be removed as promptly as possible, in order to save the patient from the inflammation which is likely to follow its presence, and which may by its swelling completely occlude the air-passages. The patient's efforts—coughing, gagging, and vomiting—may expel the foreign body, or it may be extracted by a finger passed well down the throat. If these simpler means do not suffice, the pharynx and larynx should be inspected with a laryngeal mirror in a good light, and the foreign body extracted with forceps. If the patient lies on his back, with the head lower than the shoulders, extraction is facilitated. A child may be turned upside down in an effort to shake out the foreign body, only for a few moments. If respiration is seriously interfe with and does not improve, tracheotomy is indicated (p. 119).

If the foreign body has entered the esophagus, it is likely be arrested by the projection of the cricoid cartilage. In this c it may still be extracted by forceps introduced through the mou If it is of such a nature that it is safe to allow it to enter stomach, the patient should try to crowd it forward by swallow pultaceous material, such as well chewed bread. If the fore body passes the cricoid it may be arrested at the cardiac orific the stomach. This has happened a number of times when artifi teeth have been swallowed. This condition will usually requir gastrotomy. Time may be taken for this, however, as the im diate distress ends with the passage of the foreign body to lower portion of the esophagus.

If the foreign body is in the trachea or still lower in one the bronchi, it may be extracted through the natural passa through an opening made in the trachea (tracheotomy, see p. 11 or through an opening made directly into the bronchus. This will, of course, not be attempted unless the body has been exa located by means of the X-ray. It will always remain one of rare major operations, the details of which need not be here cussed. After the foreign body has been removed, the pati should gargle with normal saline solution, or use an alkaline th spray (Dobell's solution, glycothymolin, etc.).

Wounds.—Wounds of the neck, especially stab-wounds, relatively common. Their interest, too, centers in the injury the deep structures which may coexist. The jugular vein may opened by a stab-wound or by a cut, as with a razor. Edema the lax tissues may speedily become distressing. Death from h orrhage is easily possible. Attempts at suicide with a razor o extend no deeper than the jugular vein, although there are stances in which an individual has succeeded in dividing most the structures of the neck as far back as the vertebræ. A cut, e though much less extensive, may open the air-passages, usu between the hyoid bone and the thyroid cartilage.

TREATMENT.—Experience has shown that an incised vein m be sutured and its continuity restored, but it is scarcely wo while to attempt this with the external jugular, as interruptio its blood current has no significance. In general the decision should be to ligate all the large vessels, to suture with catgut any opening into the air-passages, and to provide for the subsequent performance of tracheotomy should the breathing become difficult through swelling of the larynx. These steps may all be performed under the influence of a local anesthetic unless the patient, very likely insane, refuses to remain quiet.

It is better not to trust to pressure to control hemorrhage except in the most superficial wounds. Pressure may stop the flow of blood at the surface, while allowing it to continue in the deeper planes of tissue. This is especially true in the case of irregular or punctured wounds, which should be immediately explored to their depths, even though it is necessary to enlarge the wound in the skin. Veins as well as arteries should be ligated with fine catgut.

Wounds of the Esophagus.—A stab-wound of the neck, without giving rise to serious symptoms, may penetrate the esophagus. Under such circumstances there will be a slight mucous discharge to which may be added milk, water, etc., when the patient swallows these fluids. Such a wound, if it has good drainage, will generally close spontaneously in the course of two or three weeks; but one should be on his guard against infiltration of the deeper tissues or a burrowing of pus and food along some fascial plane. If necessary the external wound must be enlarged to afford free drainage.

If the opening into the esophagus cannot be satisfactorily sutured, a soft rubber tube should be passed into the lower portion, through which the patient can be fed temporarily until the wound has time to close by granulation, or permanently, if the loss of the wall of the esophagus is permanent.

Tracheotomy.—Tracheotomy performed upon a normal adult is a simple operation. A vertical incision is made in the median line from the cricoid cartilage downward for a distance of an inch or more. This wound is deepened until the surface of the trachea has been bared in the median line for about an inch. A scalpel is then passed through the anterior wall of the trachea. The sides of the incision are separated by means of sharp hooks or an especially devised dilator, and the tracheotomy tube is inserted. The whole procedure may be performed without an assistant, and in case of need an opening has been made with a jac knife and death from strangulation thus averted. In an infa struggling for air and violently moving its larynx up and dow the operation is far more difficult. The principles are the sam but the neck is so short that exposure of the trachea for a sufficie distance and its division in the median line are by no means eas In adults, under circumstances in which an emergency oper tion is necessary, the distance from the skin to the trachea is oft greatly increased by edema, extravasation of blood, and veno congestion.

The instruments which are essential for this operation are dissecting and mouse-tooth forceps, scalpel, scissors, artery clam small sharp and blunt retractors, a curved dressing forceps a specially constructed tracheal dilator, and a tracheotomy tu (Fig. 73). The patient lies upon his back with the neck ful extended over a hard pillow or sandbag. An incision is made the median line from the cricoid cartilage downward for an in and a half. Veins as they appear should be divided betwe clamps, or clamped as they are cut, until the trachea is reache The isthmus of the thyroid should be drawn upward. If time p mits, all hemorrhage should be controlled before the trachea opened. This is done by a median vertical incision for a distan of three-quarters of an inch. The walls of the trachea are he apart by two narrow blunt retractors or by the tracheal dilat Mucus or a possible foreign body is sponged away or removed means of a curved dressing forceps, and the tracheotomy tube inserted. The wound in the soft parts, if unnecessarily lar should be partly closed by suture. A flat collar of gauze, impr nated with some antiseptic, should be placed between the shi of the tube and the wound, while the tube itself is held in positi by two tapes tied at the back of the neck. A moist sponge shou be kept over the mouth of the tube in order to keep the inhal air warm and moist.

Upon the care of a tracheotomy tube depends in no small me ure the early cure of the patient. Mucus may be removed fr the tube by a small wisp of wet cotton on a bent probe. If t tube is a single one, it should be removed and cleaned at least o a day. The wound should be frequently cleansed. Only the mi est antiseptics are permissible in such a situation. A double tu

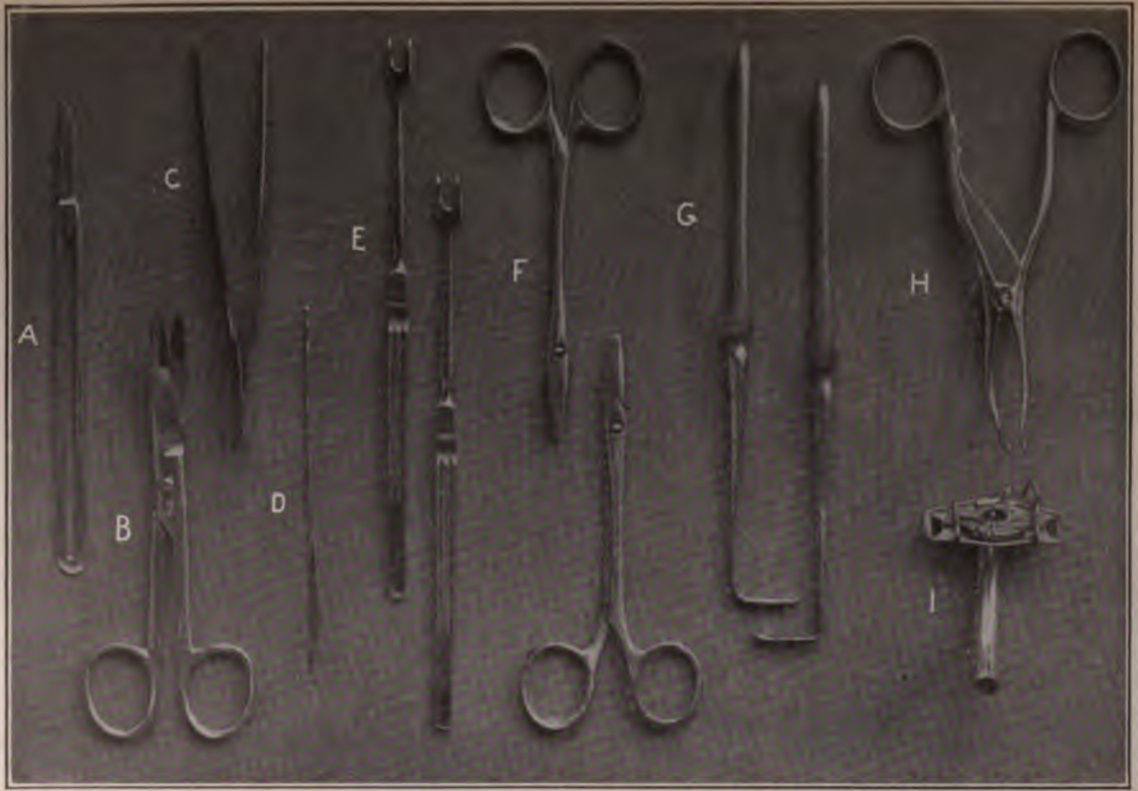


FIG. 73.—INSTRUMENTS USED FOR TRACHEOTOMY. *A*, scalpel; *B*, curved scissors; *C*, forceps; *D*, probe; *E*, hooked retractors; *F*, artery clamps; *G*, blunt retractors; *H*, tracheal dilator; *I*, tracheotomy tube. The blunt retractors *G* are not needed if one has the tracheal dilator *H*.

while leaving less space for the air, has the advantage that the inner tube can be removed at any time without disturbing the wound, and it can always be replaced without difficulty. Tubes are also made in such a manner that either the outer or inner tube can be removed and replaced without disturbing the other. Thus the tube left in place acts as a guide for the insertion of the other.

Intubation.—This little operation consists in the introduction into the larynx of a rigid tube so as to permit respiration tc go on in spite of swelling, or an accumulation of mucus or membrane, which might close the glottis. It is chiefly performed ii cases of diphtheria. With the ingenious instrument devised bj O'Dwyer, the introduction of the tube is comparatively simple The patient is held firmly in an upright position, the mouth gaj is inserted, and the forefinger of one hand is passed into the throa until the tip of the epiglottis can be felt. With this finger as guide, the tube is passed into the larynx. The instrument witl which the tube was introduced is then released and withdrawn the finger holding the tube in position meanwhile. As a precaution against mishaps, the tube may be threaded on a long looj and the thread removed only when the operator is sure the tube i in position.

In removing the tube, the patient is again placed in an uprigh position, the mouth gag is inserted, and the forefinger passed int the throat until the tube can be felt. It acts as a guide to th extracting instrument. The withdrawal of the tube is more diff cult than its insertion, so that if a tube is inserted merely as temporary measure, it is well to leave the loop of thread in pos tion to facilitate extraction. If this is done the loop may be fa tened over the patient's ear.

Sprain of the Cervical Spine.—The lower portion of tl spine is more often the seat of sprain than is the upper portioı This may be due to the greater flexibility of the cervical spin However, sprain of the neck is by no means uncommon. It ma follow falls or blows of various sorts.

The symptoms are pain and tenderness, especially when certa movements are made, against which the patient often protects hir self by muscular contraction. External signs, such as edema ar ecchymosis, are usually wanting. There is no true deformity, though the patient for his own comfort may keep the head out of the median line. Thus an injury of this sort, if not properly treated, may lead to wryneck. Symptoms of shock may be present, but are usually wanting in cases of simple sprain.

DIAGNOSIS.—The essential point in the diagnosis is not to overlook a more serious injury, such as fracture, or injury of the cord, received at the time of accident, or due to pressure of the hematoma. Hence the patient should be carefully examined, the extent of the various normal motions of the neck tested and recorded (for the method see p. 162), possible paralysis, either sensory or motor, investigated, and any other symptoms noted. This is the more important in cases of spinal injury, out of which damage suits may arise.

The possibility that a dislocation has occurred and has been spontaneously reduced should also be borne in mind. The chief significance of this is the damage to the cord which may have occurred through undue pressure. Another possibility to be thought of is commencing tuberculosis.

TREATMENT.—Treatment consists in rest in a correct position, with hot or cold applications to relieve pain. Later, massage and passive and active motions should be instituted in order to regain the full range of motion. If the patient has a tendency to hold the head in an abnormal attitude, this should be corrected, even though it is necessary to give an anesthetic and to apply a plaster of Paris bandage to the head, neck, and chest. This should not be continued very long, lest stiffness result. It is therefore better to remove it in a week, and to begin treatment by manipulation.

Fractures.—Fracture of the Hyoid.—Attempts at strangulation may cause fracture of the hyoid bone. The usual symptoms of fracture, pain on motion, swelling, and ecchymosis, are present but may be rather slight. In case of the hyoid bone, crepitus will probably be obtainable. To these ordinary symptoms there may be added pain on swallowing, or cough, or swelling of the larynx so great that tracheotomy becomes necessary. If no displacement is present, the parts will unite without treatment. If there is displacement, it is better to make an incision and suture the fractured cartilage or bone with catgut, so as to avoid deformity. No apparatus is required to hold the fractured ends in normal position if there is no tendency to displacement, but a few strips of adhesive plaster or immobilization of the head will give th patient comfort.

Fracture of the Larynx.—In fractures of the larynx the thyroi cartilage is usually involved; the fracture may or may not b complete. As the mucous membrane of the larynx is often ruptured, blood flows into the trachea and excites a most painfu cough. Swallowing and talking are also painful. The thyroi is flattened; there is marked edema, and frequently emphysem If the fracture is complete, crepitus is easily obtained.

This is a very dangerous injury, statistics showing that mor than one-third of the patients who suffer from it die. As deat usually comes during an attack of dyspnea, tracheotomy should b immediately performed, except possibly in simple cases when th patient is so situated that tracheotomy can be performed at moment's notice. Subsequent treatment should be directed towar keeping the fracture aseptic, controlling hemorrhage, and preven ing stenosis. To accomplish these measures it is often necessa to perform laryngotomy.

Fracture of the Trachea.—This injury occurs less often th fracture of the larynx. The symptoms in general are simila Dyspnea and emphysema are the most alarming ones, and are fr quently the cause of death; or death may follow at a later peri from inhalation pneumonia.

The treatment is similar to that recommended for fracture the larynx. If there is no dyspnea and no emphysema, trach otomy may be deferred, but the patient should be kept under stri observation for several days.

Fracture of the Cervical Spine.—Fracture of the cervical v tebræ may be due to direct violence, but it is generally the res of blows or falls upon the head. It is not necessarily fatal, but often accompanied by injury of the cord sufficient to termin life either immediately or after the lapse of a few weeks. T symptoms are the usual ones of fracture, namely, pain on pr sure and on manipulation, abnormal mobility and crepitus, p sibly swelling and ecchymosis. Some of these symptoms may masked by the numerous strong muscles which surround the v tebræ, and which are kept contracted to prevent the pain due motion of the neck.

The cord is usually injured, either pressed upon, or partly wholly crushed. There is, therefore, almost always more or less paralysis, sensory or motor, or both.

Prognosis, on account of the injury to the cord, is bad, worse than when the lumbar spine is fractured.

TREATMENT.—If no cord symptoms are present, treatment consists in the immobilization of the spine, possibly with extension and counterextension. If there is a partial or complete paralysis, the spinal canal should be opened posteriorly (laminectomy), and depressed fragments of bone or compressing blood-clots removed. Unfortunately the paralysis is usually due to crushing of the cord at the time of the accident, and not to pressure. Hence it is only occasionally that an operation benefits the patient.

Dislocation of Vertebræ.—This injury may be due either to direct violence or to a fall. If the dislocation is complete, it is often found to be associated with fracture and to have produced fatal lesions of the cord. There are instances, however, in which dislocation is only partial and in which the cord escapes serious injury. This is especially true when a partial dislocation takes place between the axis and atlas. Such a patient may escape paralytic symptoms and may live with the dislocation unreduced.

TREATMENT.—If the head and body are pulled strongly apart and the neck is manipulated, the dislocation may be reduced. This procedure is not without risk of sudden death. It should be performed with the greatest steadiness and gentleness, preferably under an anesthetic. Otherwise the treatment consists in immobilization of the neck, followed by massage and manipulations (compare the treatment for Sprain, page 123).

INFLAMMATIONS

Burns.—The neck is often the seat of severe burns, especially when the clothing catches fire. Such burns, if deep, are likely to result in deforming contractures, even to the extent of drawing the chin down upon the chest (Fig. 87, p. 148). For the treatment of burns see page 26. Contraction should be prevented by keeping the burned area extended during healing by means of a plaster of Paris splint fitted to the opposite side of the neck.

Cellulitis and Erysipelas. Superficial cellulitis and erysipelas occurring in the neck present no peculiar features. For description and treatment of these disorders see pages 33 and 35.

Boil.—The back of the neck is a favorite seat for boils. A furuncle or boil is a local suppuration due to staphylococci. The inflammation begins in the skin usually at the root of a hair. There is a purulent center, surrounded by a red, edematous area. The swelling and pain vary. Sometimes the inflammation is so intense that necrosis of the deeper portion of the skin takes place. This necrotic slough is called the "core" of the boil. If the boil forms where the skin is delicate, the pus very soon breaks through to the surface. In the back of the neck, where the skin is often a quarter of an inch thick, it is sometimes several days before the necrotic center of the boil, popularly called the core becomes softened and separated from the surrounding skin, so tha the contents of the boil are able to discharge themselves spontaneously; and sometimes, instead of discharging on the surface the pus finds its way into the subcutaneous fatty tissue, forming an abscess there. A boil does not tend to spread beyond it immediate vicinity, and after its discharge it usually goes on to recovery without giving rise to other than a local cellulitis. The process, however, is apt to be repeated, often many times, in the vicinity of the first lesion, each new boil developing separately a if it were the only one, from infection through the hair-follicles due to the smearing of pus on the surface.

TREATMENT.—The best treatment is to evacuate the abnorma products already formed and to hasten or cut short the pathological process. At the back of the neck the skin is thick and th inflamed area is proportionately great, so that the introduction of a drop of carbolic acid will not usually stop the infection, as i often will in case of a small boil of the face (p. 36). Most surgeons still follow the domestic plan of poulticing such a lesion fo a couple of days until there is a well marked center to the suppuration. This poultice treatment is generally continued too long. T keep up the poultices until there is simply a soft pus-sac to b opened simplifies the operation, but it prolongs unnecessarily th sufferings of the patient, and by increasing the size of the cavity which has to be closed in healing, it delays ultimate recovery. I most instances, as early as the second day, it is possible to sa where the center of the boil is located, and if a short incisio is made clear through the skin at this point and a wet dressing is applied, not only will the patient be saved one or more days of intense suffering, but the inflammatory process will rapidly subside and there will be very little necrosis of the skin to be made good by the growth of the new tissue. Any violent attempts at curetting or squeezing out the necrotic tissue or pathological products are to be condemned, as these substances will come out of themselves in a few hours, while the violence adds somewhat to the sum total of injured tissue and may set up a severe cellulitis. A strip of rubber tissue or gauze should be inserted to favor the escape of pus.

An injection of cocain or eucain directly into the inflamed skin over a boil is a very painful proceeding. It is therefore better to begin the anesthetization at a little distance from the inflamed area, so that as new punctures are made nearer the center they shall enter tissue in which sensation has been benumbed. It is in operations of this character that a freezing spray of ethyl chlorid proves satisfactory. For other details of treatment see Chapter XX.

The after-treatment of a boil is simple. The wet dressings should be continued for a couple of days, until the discharge is at a minimum, when an ointment, such as balsam of Peru, one part, vaseline, eight parts, may be substituted.

The advantages of the poultice may be obtained without its disadvantages by applying heat to the outside of the wet dressing. For this purpose a hot-water bag or bottle, or a hot brick or flat-iron, may be used. It is easy to produce and maintain as high a temperature as the patient can stand, by changing the bottle as soon as its temperature falls. In this manner the gradual cooling of the poultice and discomfort and trouble of its renewal are avoided.

Carbuncle.—A carbuncle is a suppuration which, unlike that of a boil, has a tendency to spread laterally through the cutaneous tissues. Local abscesses are formed in the various hair-follicles, and the interstices of the skin become saturated with pus, and there is an extensive cellulitis with necrosis of more or less of the true skin, besides the usual symptoms of infection (Fig. 74). A carbuncle also extends downward, and the subcutaneous fat is usually involved in all except very mild cases. From this brief description it appears that an extensive carbuncle is a serious trouble which not infrequently terminates fatally.

TREATMENT.—It is important that incisions should be made through the skin before the process has extended widely. As many as possible of the small abscesses should be opened by the incisions, which may be made at intervals of one-fourth or one-third of an inch, both vertically and horizontally; or they may radiate from a central point (Fig. 75). Some few surgeons advocate the complete excision of a carbuncle, but this causes the loss of an unnecessary amount of tissue. A compress wet with a strong antiseptic solution should be applied and kept hot in the manner described above. It may be necessary on the following day or at a later period to make other incisions to permit the escape of newly formed collections of pus. Figure 76 shows the outcome of a very bad case.

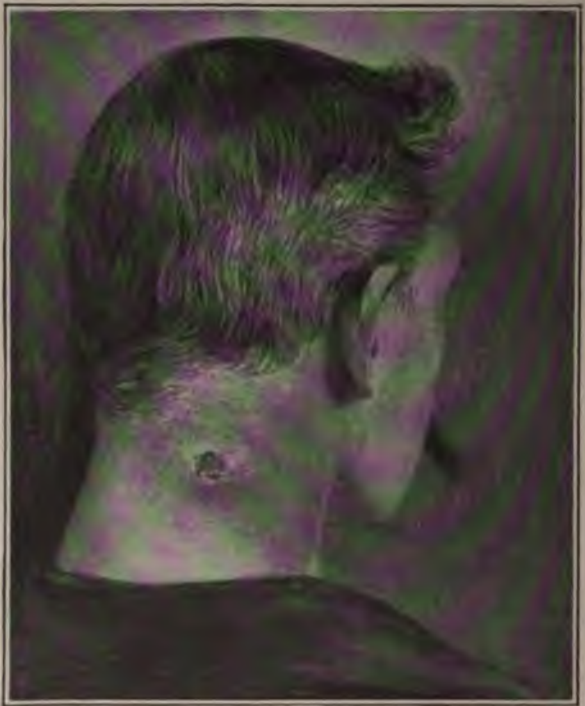


FIG. 74.—CARBUNCLE OF NECK. Note the flat top, and several points of suppuration.

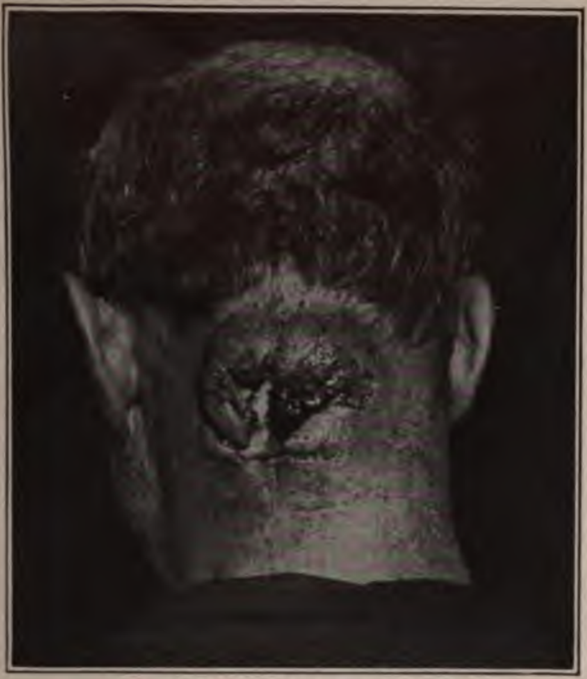


FIG. 75.—CARBUNCLE OF NECK. Duration, four weeks; incised three times, gangrene of one flap. Scar from similar operation for carbuncle twenty years previous. Patient aged fifty-two years.

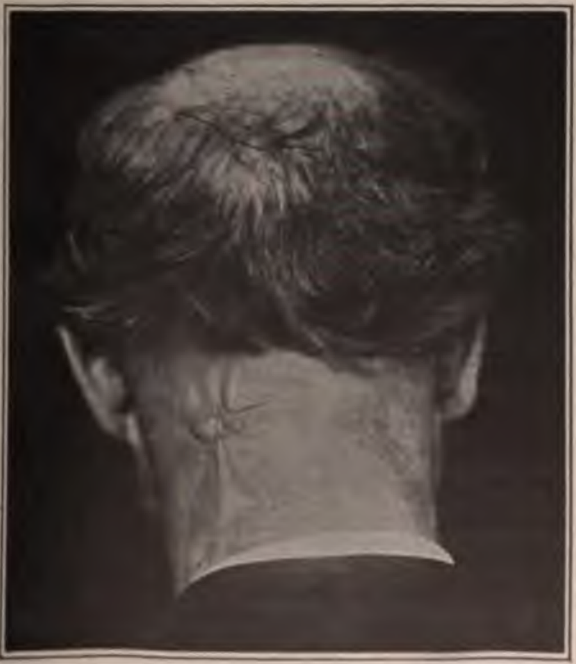


FIG. 76.—SAME PATIENT AS SHOWN IN FIG. 75, BUT ELEVEN WEEKS LATER.

Abscess.—Abscesses may also form in the neck as the result of infection in some other situation. This is notably the case in neglected children, who scratch their heads to find relief from the itching set up by pediculi. The epidermis is broken, a slight cellulitis results in the scalp, and the infection follows the lymphatics to a cervical gland and produces an abscess in the neck (Fig. 77). It is usually possible to find the starting-point of the infection under such circumstances. Such an abscess is wholly subcutaneous and is not possessed of the virulence either of the boil or the carbuncle. It should be opened and treated according to the plan laid down for abscesses of the scalp (p. 34).

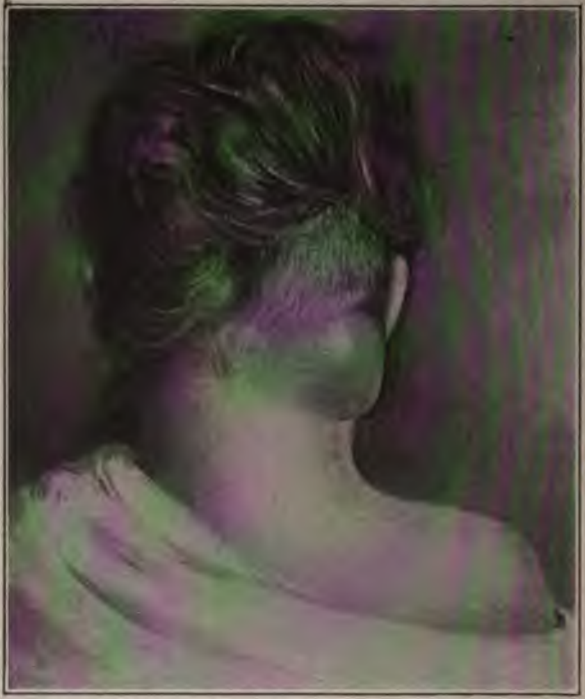


FIG. 77.—ABSCESSES OF NECK. Duration two weeks, secondary to pediculosis capitis, occurring in a child of two years.

The pediculi should be removed to prevent recurrence of the trouble. Applications of benzin, or kerosene, or tincture of delphinium and ether, followed by a shampoo, will accomplish this.

Deep suppuration of the neck, due presumably to infection from the mouth, sometimes develops rapidly. In a day or two the whole front or side of the neck may be swollen, brawny, and, later, saturated with pus, while chills and fever show the gravity of the affection. This trouble has often been called *angina Ludovici*. It deserves early radical treatment or it may speedily lead to a fatal termination. The tension should be relieved by incisions sufficiently numerous and deep to open any pockets of pus and allow the escape of the greater part of the exuded fluid. If operation is delayed until the whole front of the neck is involved, the prognosis is decidedly unfavorable.

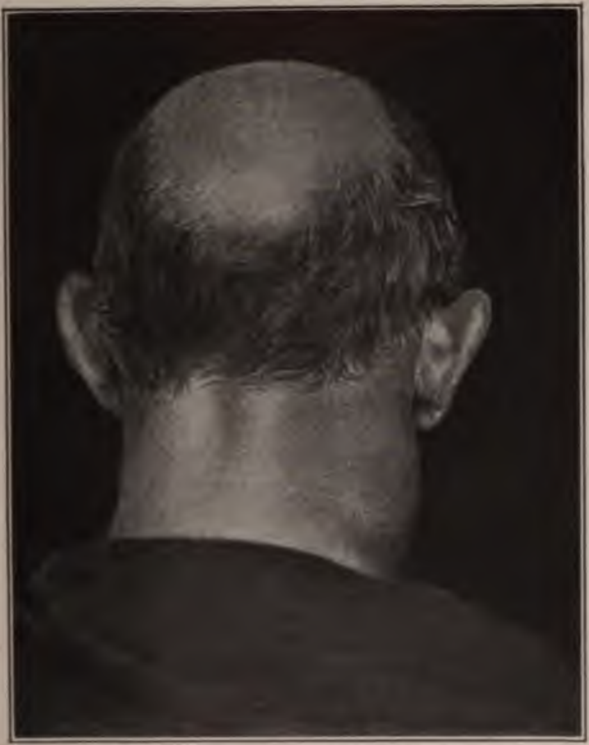


FIG. 78.—ABSCESS UNDER STERNOMASTOID MUSCLE. Six months' duration; probably tubercular. Patient aged fifty-six years.

A slowly forming deep abscess of the neck may be due to breaking down of a tuberculous gland (Fig. 78), or to a mixed infection in case of syphilitic ulcerated throat. Abscess of the cervical lymphatic glands secondary to alveolar abscess, is spoken of on page 42.

Anthrax.—Anthrax or malignant pustule is a disease not common in this country. It usually develops in a man who has been handling infected hides. The first lesion appears upon the hand or some part of the body that the hand has touched. It is a hard, raised, flattened, reddish nodule, with a surrounding zone of more or less indurated cellulitis (Fig. 79). It shows little tendency to necrose in the central portion. The constitutional symptoms are severe and out of proportion to the local manifestations, although they may not become so until several days after the infection has taken place. The diagnosis can only be made with certainty by an examination of the serum and blood obtained from the pustule. The anthrax bacillus is large and has square ends, like the segments of a mature tapeworm, so that it is readily recognized in a stained smear by a simple microscopical examination. As confirmatory evidence, cultures should

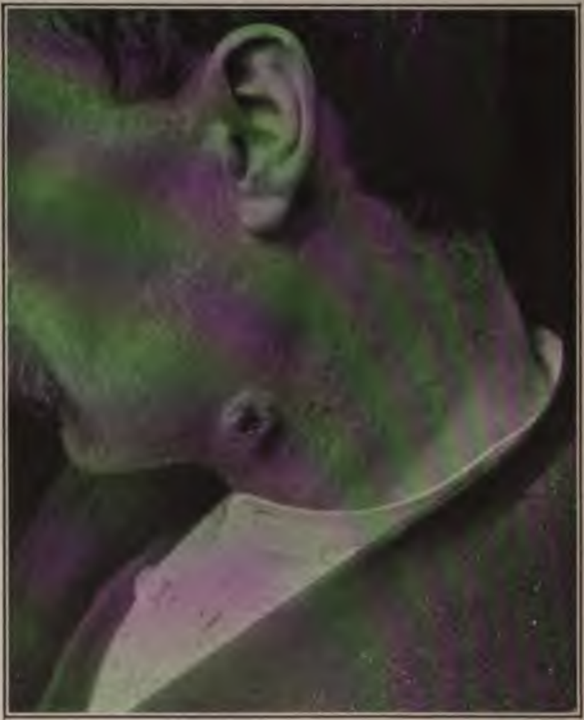


FIG. 79.—THE PRIMARY LESION OF ANTHRAX. Diagnosis confirmed by microscopical examination of discharge from the ulcer, and of the blood.

be made. The bacillus grows readily upon any of the common culture media. If a positive diagnosis is made, the local lesion should be immediately excised. Further operative measures are generally useless, as the disease spreads through the blood as well as through the lymphatic system. A fatal termination is common, but is by no means invariable, so that life should not be despaired of at once.

Cervical Tuberculosis.—Tuberculosis in the neck is situated either in the lymph-glands or in the spine. Tubercular lymphadenitis is described, with other enlargements of the glands, on page 142.

Tuberculosis of the bones of the neck or cervical Pott's disease, as it is called, is a condition which in its early stages is apt not to be recognized. Owing to the fact that the spines of the vertebræ are not so plainly to be felt as those in the back and in the lumbar region, the diagnosis is not so simple as it is in the latter situations. The first symptoms noticed are pain, stiffness, and rigidity of the neck. Later there is swelling of a diffuse character, making the neck somewhat thicker than before. There is great pain when the neck is bent, either by the patient or by the examiner. The trouble may be differentiated from acute suppuration by the gradual onset of the disease, by the low fever, and the absence of surface heat, edema, and redness. From wryneck and the acute myositis which precedes wryneck, it can be differentiated by the situation of the swelling. In cervical Pott's the swelling is invariably in the median line, though it may extend more to one side or the other. In myositis or wryneck the swelling is lateral or well to the front. In wryneck the chin is directed away from the side on which the sternomastoid muscle is prominent. In cervical Pott's the chin is directed toward the affected side. In wryneck correction of the deformity is prevented by the bands which spring into marked relief when correction is attempted. In cervical Pott's an attempt to correct the deformity is painful, and will be resisted by the hands of the patient.

TREATMENT.—The object of treatment is to obtain relief from the weight of the head and to keep the parts at rest. This is accomplished by an apparatus known as a jury-mast which lifts the weight of the head by a strap placed under the occiput and under the chin. The instrument rests upon the back and shoulders and is secured in place either by straps or by a plaster Paris bandage. Whether the disease will be arrested or progr to an unfavorable termination will depend upon the age of patient, the hygienic surroundings, etc., more than upon lo treatment.

CHAPTER V

TUMORS AND DEFORMITIES OF THE NECK

TUMORS

Sebaceous Cyst.—This variety of tumor is found in the skin of the front and back of the neck, but with less frequency than upon the head. It presents no peculiarities on account of its situation, so that what has been said of the diagnosis and treatment of sebaceous cysts of the head is applicable here (see p. 66).

Thyroid Cyst. (See Goiter, p. 145.)

Thyreoglossal Cyst.—The region of the larynx is a favorable site for congenital cysts and sinuses developing from some remains of the thyreoglossal duct, which at an embryological period extends from the base of the tongue through the hyoid to the thyroid cartilage. If the remains of such a duct open externally, one or more sinuses will persist and will discharge mucus. If the remains of the duct do not open externally or into the mouth, the secretion may give rise to a cyst containing mucus. Such a cyst is easily opened and its contents evacuated, and the sutured skin will heal *per primam*. In the course of a few days or weeks, however, the fluid will reaccumulate and the tumor will reappear. In order to avoid this unpleasant result the treatment should be thorough. The scar following an unsuccessful attempt to remove a thyreoglossal cyst is shown in Fig. 80. This also shows the situation of the original sinus or cyst. If a sinus exists, it is invariably in the median line.

Treatment.—The only successful treatment is the complete removal of the cyst and its duct. The situation is a conspicuous one and it is desirable to leave as small a scar as possible, yet the dissection must be deep enough to expose the abnormal tissue, both above and below the hyoid bone if need be. The skin should be cocainized or the patient given a general anesthetic. The incision should be made directly in the median line and more above than below the center of the tumor, as it is necessary to follow it upward. The dissection and removal of a rounded cyst is easy; that of a narrow sinus is more difficult, since it is often impossible to recognize it when it becomes attenuated. Even when there is a well marked cyst, an inconspicuous sinus often leads from its upper part. It has been suggested that such a sinus be injected with a solution of methyl blue, so that the operator may follow it more readily.

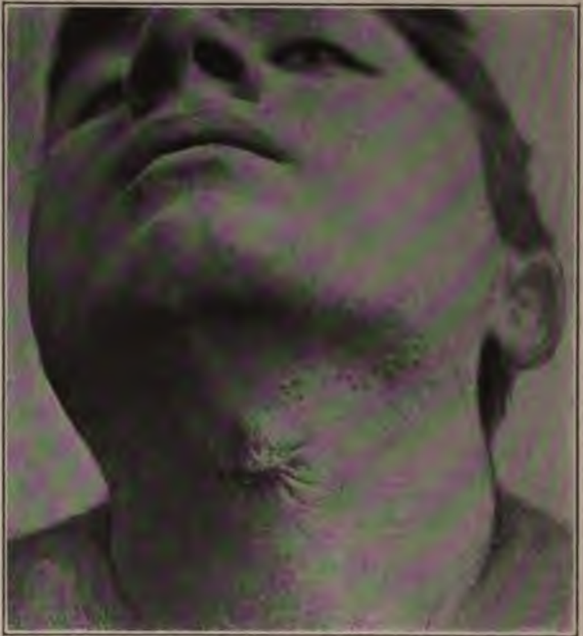


FIG. 80.—THYREOGLOSSAL CYST; OPERATION; RECURRENCE. Note the position of the cyst in the median line just below the hyoid bone.

When the congenital tissue has been followed to the hyoid bone there will often be found a perforation of the bone. The lining of this should be curetted away, and if the sinus exists above the hyoid it should be followed and removed. When this has been done, the patient will have been given the best chance against recurrence, but a guarded prognosis should be given. The wound should be sutured entirely, or over a minute drain in its lower angle.

Branchiogenic Cysts and Sinuses.—Other congenital cysts and sinuses may be found in the sides of the neck, having developed from the remains of the branchiogenic clefts, or at the base of the ear and posterior to it. These tumors are sometimes made up of a few larger cysts and innumerable smaller ones, and contain either a clear serous fluid or one made thicker by the presence of mucin and other albuminous substances. They are benign in character, but on account of the deformity and their tendency to keep on growing they should be removed as thoroughly as possible.

In making a diagnosis of a lateral cervical cystic tumor, aneurism of the carotid or one of its branches should always be considered. One thinks at once of expansile pulsation as a means of differential diagnosis. It should be borne in mind that if a tumor, cystic or solid, lies upon the carotid artery it receives an impulse from the arterial beat. This impulse may be mistaken for expansile pulsation unless a careful examination is made.

Lipoma.—A fatty tumor or lipoma is probably the commonest solid tumor of the neck. It occurs in three forms: simple, diffuse, and intermuscular.

A simple lipoma is a well encapsulated tumor lying in the subcutaneous plane of fascia. It seems to form a part of the subcutaneous fat, but it soon exceeds this fat in thickness and is usually covered by a thin layer of this fat. It may be found in any portion of the neck (Fig. 81). It tends to grow larger, and this causes an ever-increasing deformity. This is the one reason for its removal.

TREATMENT.—A local anesthetic is sufficient unless the patient is very sensitive. The incision in the skin should usually be parallel to or lie in one of the circular wrinkles of the neck. A transverse incision is also preferable if the tumor is situated at the back of the neck. The incision should be deepened until the capsule of the tumor is plainly seen. This is usually covered by some normal subcutaneous fat, and if the operator attempts to dissect out the tumor before the true capsule is reached, the difficulties are unnecessarily increased and a ragged cavity will result. When the correct plane is reached the whole tumor can be quickly shelled out with blunt dissection either with the fingers or with closed, blunt-pointed, curved scissors. There is scarcely any bleed-

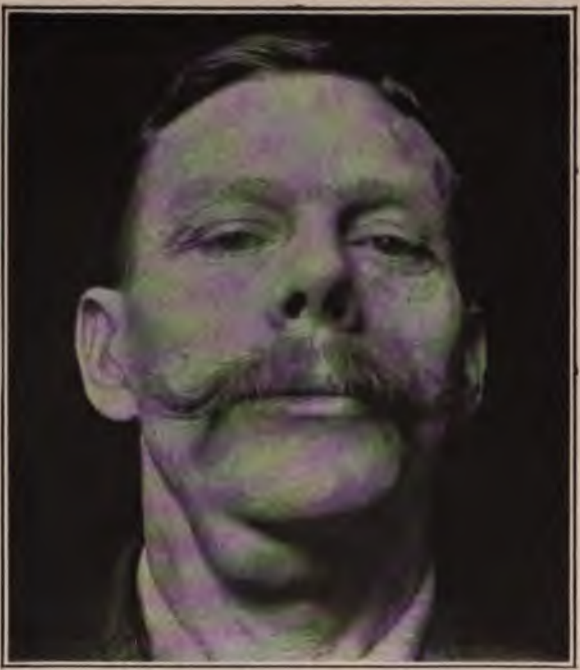


FIG. 81.—SIMPLE LIPOMA OF THE NECK OF TWO YEARS' DURATION.

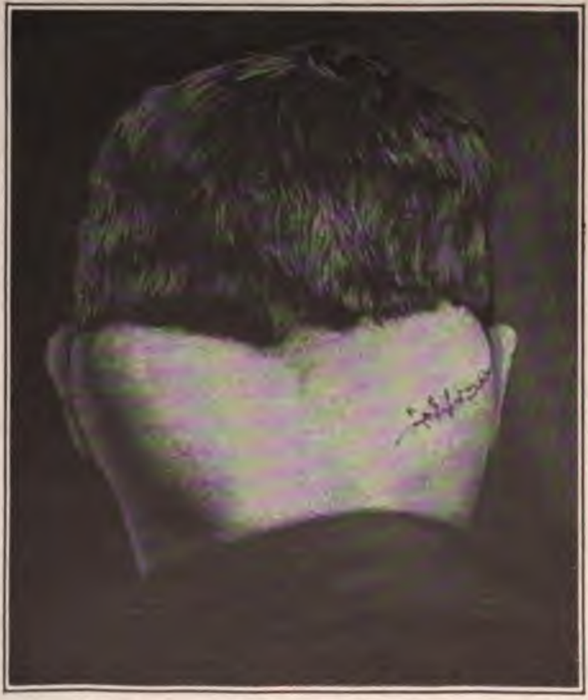


FIG. 82.—DIFFUSE LIPOMA OF THE NECK. This tumor was symmetrically bilater
One portion was removed five days before the photograph was taken.

ing, but the wound should be inspected for it, and if any bleeding vessel exists, it should be ligated with fine catgut lest a hematoma fill the cavity left by the removal of the lipoma, and for a time continue the deformity. The wound should be completely sutured with horsehair or fine black silk and elastic pressure applied by means of a gauze and cotton dressing and a firm bandage. This may be removed in three days and any small dry dressing be reapplied. The stitches should be removed—one-half on the fourth day and one-half on the sixth day, or sooner if the wound is a small one.

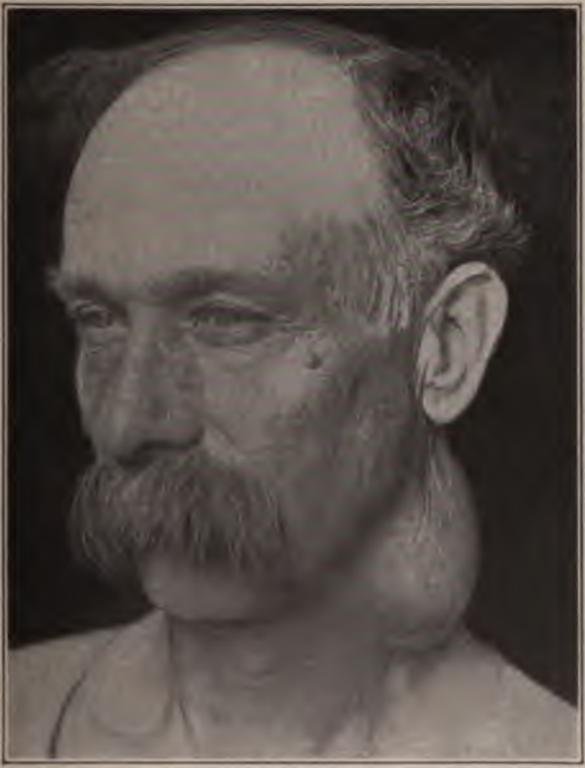


FIG. 83.—FIBROMA OF NINE YEARS' DURATION, APPARENTLY STARTING IN THE FASCIA ABOUT THE STERNOMASTOID MUSCLE.

Diffuse Lipoma.—The second variety of lipoma develops in connection with the deep fascia. It is not encapsulated; it contains more fibrous tissue than the other two varieties, and its removal is difficult and unsatisfactory. It usually develops symmetrically on both sides of the neck (Fig. 82). Fortunately it is rare.

Intermuscular Lipoma.—The third variety of lipoma develops in the fascia between the muscles. It is found in the neck, trunk, and extremities. In structure it resembles the simple lipoma, being made up of lobules of almost pure fat, each surrounded by a complete delicate capsule. The dissection for its removal is therefore easy, but the extensive ramification of the tumor between the various muscles sometimes makes necessary a pretty long wound.

Fibroma.—A pure fibroma, wholly subcutaneous, is not a very common tumor in any portion of the body. Such a one developing slowly in connection with the left sternomastoid muscle is shown in Figure 83. It was removed without difficulty, being fully encapsulated (Fig. 84).

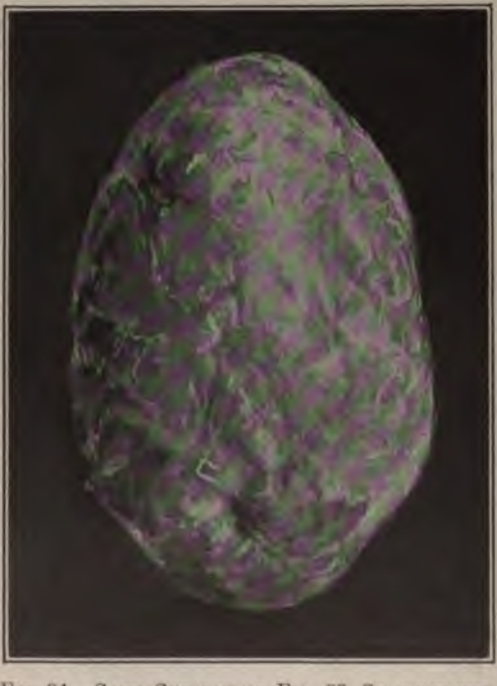


FIG. 84.—SAME SUBJECT AS FIG. 83, SHOWING THE TUMOR AFTER REMOVAL. It was fully encapsulated and easily removed.

Enlarged Lymphatic Glands.—**Acute Lymphadenitis.**—The most common tumor of the neck is a swollen lymph-gland. In the strict use of the term this is not a tumor at all but an inflammation, a lymphadenitis. But for clinical reasons it is well to class these enlarged glands with the tumors. The cervical glands are especially liable to swell on account of infection from bad teeth, or from throat troubles, such as ulcerated tonsil, or from inflammation in or about the ear, as well as from infected wounds of the skin. A very common source of lymphadenitis of the posterior cervical glands in children is pediculosis capitis. The child scratches the scalp to relieve itself of the intolerable itching, the scratches become infected, and the glands swell. An extreme case in which the glands have broken down and two large abscesses have resulted is shown in Figure 77, page 130.

Whatever the source of infection, the glands lying in the path of the afferent lymph-vessels will become inflamed. One or more of them swells until it presents itself as a smooth, round, movable tumor, above which the skin is also freely movable. If the severity of the inflammation causes the gland to break down, fluctuation is obtainable and the inflammation extending to the skin will prevent movement of the latter over the gland. Later the abscess may break through the skin. Often, however, the infection, being of a milder character, does not extend beyond the capsule of the gland, and the acute symptoms of infection are wanting in the periglandular tissue; or the inflammation in the glands themselves may be of a more chronic form. In such a case the swelling of the gland will be painless, and there will be little tenderness even on pressure.

One should never be satisfied with a diagnosis of simple lymphadenitis. The source of the infection should also be determined. If no cause for the swelling of the gland can be ascertained, the possibility of tuberculosis should be kept in mind.

TREATMENT.—If the infection of the gland has not proceeded to demonstrable suppuration, the attention may be directed to the prevention of further infection by the treatment of the infected teeth, or sore throat, or wound of the skin. When the source of infection has been shut off, acute lymphadenitis will take care of itself in many cases.

If fluctuation can be made out in a gland, the process will rarely undergo resorption without a discharge of pus. In such cases it is better therefore either to drain the gland or to remove it entirely if this can be readily done. For if the glandular tissue is riddled with pus and germs, but has not necrosed, the relief of tension, when the abscess is incised, will give it a new lease of life, so that this glandular tissue may remain a long time in the wound, discharging constantly a purulent secretion and delaying wound-healing in an aggravating manner. If the whole gland is removed with its capsule, union of the sides of the wound will be promp and often primary.

If the infection comes from the front teeth, so that the tumo forms in the situation of the submaxillary gland, this gland is ex posed first in making the incision. It ought not to be sacrificed however, because the source of the pus is not in its substance, bu in that of one or more lymphatic glands lying just under it. I this caution is not borne in mind, the salivary gland may be need lessly excised.

Chronic Lymphadenitis, or Tuberculous Glands.—The lymphati glands of the neck are also subject to inflammatory processes c a chronic character. Many times the process is distinctly tube cular, and can be shown to be such by the presence of tubercl bacilli in the excised gland. At other times, however, the tumc develops in a similar manner and presents the same clinical appea ances, although no tubercle bacilli can be made out. Such patien are anemic, have a poor digestion, suffer from cold feet and hand and have an appearance of malnutrition although the subcutaneo fatty tissue may be abundant.

TREATMENT.—The treatment in tuberculosis is primarily hy gienic. Such treatment should precede and follow the local trea ment. Just what the local treatment should be must be determine in each particular case. If a single large gland exists, causing deformity and suggesting the possibility of enlargement of oth glands, its removal is absolutely indicated. If there are man slightly enlarged glands operation can be deferred. If there a numerous large glands, some of which are plainly suppuratin removal is necessary both to reduce the number of foci fro which the disease may spread as well as to save the patient fro abscess formation with resulting sinuses and disfiguring cicatrice

If a single movable gland is to be removed, a local anesthet suffices in many cases. If many glands are enlarged, and esp cially if one or more are adherent, the operation is a more form dable one and had better not be undertaken except with gener anesthesia; for although the enlarged glands may seem to l close to the surface, they invariably extend deeper than they a pear to do, and almost always there are others still deeper whi are concealed by the more superficial ones. A thorough oper tion in such cases means a free incision of the skin and superfici muscles and wide exposure of the cervical vessels. Such glands often lie just in front of the sternomastoid muscle and close to the internal jugular vein; others are usually found just behind the muscle or beneath it. Hence the division of this muscle greatly facilitates their removal. A transverse or U-shaped or Z-shaped incision through the skin is advocated on account of the splendid exposure it gives. The resulting scar is prominent, and should be avoided when possible, even though two separate incisions are required—one in front of the sternomastoid and one behind it. In cases of extensive involvement of the glands, it is well to remove as much of the gland-bearing fascia as possible. This requires a long and difficult dissection, which is fully described in good text-books on major surgery.

The cases which may properly be considered here are those in which there are one or more enlarged glands, freely movable and easily accessible. In such a case it is better to make the incision directly over the glands and parallel to the edge of the sternomastoid muscle. When the various planes of tissue, skin, subcutaneous, and deep fascia have been divided, there will be exposed the outer capsule of the gland. If this is also divided, the gland may sometimes be shelled out like the pulp of a grape from its skin, especially if it is still solid and the inflammation has not set up adhesions between the gland substance and the outer capsule. In that case the dissection may be tedious, but should be persisted in until the gland is removed. The rule should always be to keep close to the gland in removing it. If a little of the gland substance remains, it is easy to remove it after the gland itself has been excised; whereas if the line of incision strays from the gland itself, serious damage may be done to some important vessel or nerve.

The important structures to be kept in mind during the dissection are the internal jugular vein and pneumogastric nerve in front of the sternomastoid muscle, and the spinal accessory nerve posterior to it.

When the enlarged glands have been removed the wound should be cleansed and sutured. Even though necrotic material has been smeared over the wound by the rupture of a softened gland, primary union is still attainable in most cases if all diseased glands are removed. The finest of black silk sutures should be placed through the skin wound, thus allowing the deeper parts to collapse and assume their normal relation. Light pressure obtained by a piece of sterile gauze placed on the wound and covered with cotton and a gauze bandage will suffice to keep the deeper parts of the wound in apposition. If the wound is dry before it is sutured no hemorrhage need be feared. Even if the dissection is a limited one, it is better to confine the movements of the head for two or three days by the application outside of the gauze bandage of a starch bandage, made by tearing heavy crinolin into strips two or three inches wide. These strips are rolled and immediately before being used they are wrung out of hot water, care being taken not to squeeze out more of the contained starch than is necessary. In the case of a child, or of a restless adult, the bandage should run around the neck, up the back of the head and around the forehead, and should also extend under one or both arms (No. 22, Chapter XXI). This may seem like a very extensive dressing for a simple wound, but only in this manner can a wound in the neck be properly protected and the head kept quiet. In a day or two, when the starch has thoroughly dried, the parts of the bandage which extend under the arms may be cut away, as by that time the molding of the bandage to the shape of the neck and shoulders will be sufficiently firm. The wound should be dressed in four days, and half of the stitches removed, the rest being left in three or four days longer. From this time on a cotton-collodion dressing will sufficiently protect the wound from outside contamination. If the adult is quiet and the incision does not extend to the upper third of the neck, the bandage around the head may be omitted.

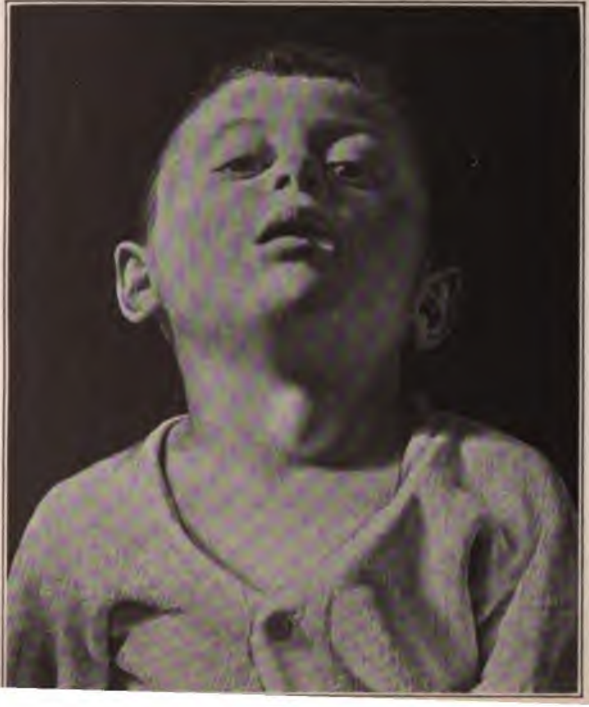
Suppurating Tuberculous Glands. — Unfortunately the clean operations above described are often impossible because the patient will not allow any operation until the pus has burst through the skin or at least has ruptured the capsule of the gland and has infiltrated the surrounding tissues. Under such circumstances the abscess-cavity must be drained through a suitable incision, but the operator should not content himself with this alone, but should make an attempt to remove all of the affected gland, either by means of a curette or, what is better, by means of forceps and scissors. If this dissection does not extend beyond the original capsule of the broken-down gland, the risk of spreading the infection by this treatment is not worth considering, and the period of recovery will be materially shortened if one does not leave behind a half disintegrated gland, which will keep a sinus discharging a small amount of pus daily for weeks afterward. If, on the other hand, the gland is wholly removed, and free drainage is given to the wound, it may be able to close by granulation in a week or two.

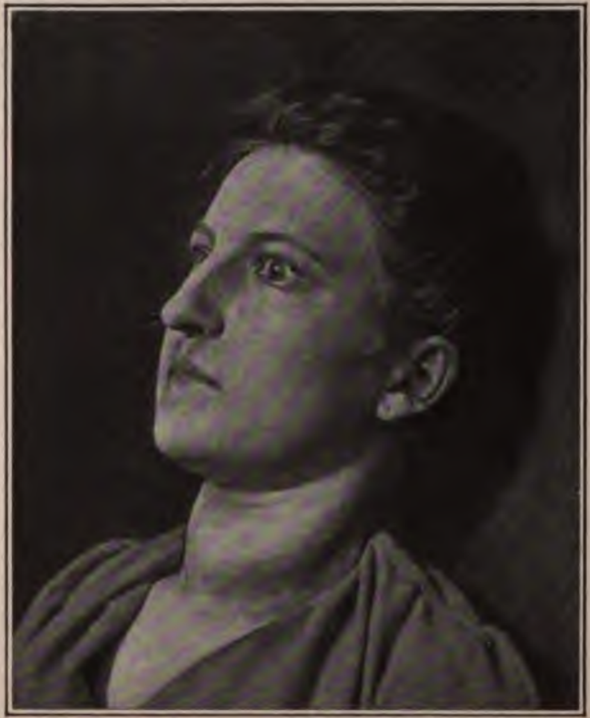
In Syphilis.—The cervical glands may be enlarged in syphilis either as an accompaniment of an ulcerated throat or as a later manifestation of the disease. In the former case, on account of the presence of pus, an incision may be necessary. Glandular enlargement due to syphilis will subside rapidly under antisyphilitic treatment, so that removal of the glands is not usually necessary.

In Leukemia, Pseudoleukemia, Sarcoma, Carcinoma.—Other causes of chronic lymphadenitis are leukemia, Hodgkin's disease, and the malignant tumors. It is well worth remembering that the cervical glands above the left clavicle have connection with the abdominal organs through the lymphatics which accompany the thoracic duct; and they may enlarge so as to be easily palpable, before the patient seeks advice for a gastric or hepatic cancer.

Tumors of the Thyroid Gland, or Goiter.—The thyroid gland is frequently the seat of hypertrophy and new growth. There may be a diffuse enlargement of a part or the whole of the gland, or there may be well marked nodules, either cystic (Fig. 85) or parenchymatous in structure. Any such benign swelling of the thyroid gland is known as a goiter. This is a common affection in certain mountainous districts in Europe, but it is by no means confined to them, and seems to be increasing in frequency in New York City, possibly on account of immigration from such regions. The larger swellings, involving the whole gland if of parenchymatous nature, are sometimes associated with protrusion of the eyeballs and certain nervous symptoms. Such a goiter is called exophthalmic goiter (Fig. 86).

DIAGNOSIS.—Tumor of the thyroid may be recognized by the fact that it is drawn strongly upward when the patient swallows, on account of the close attachment of the thyroid gland to the larynx. It is not so easy to tell a cystic from a discrete parenchymatous swelling. A diffuse swelling of even elastic consistence





Two Months'

throughout is invariably parenchymatous. A large cyst will yield a fluctuation wave when tapped upon or compressed. A small cyst and a small parenchymatous nodule react about alike in this respect. An aspirating needle will distinguish the two.

Treatment.—The removal of a cystic or a parenchymatous nodule is not a difficult procedure if the surgeon is careful to control hemorrhage step by step. Local anesthesia is sufficient. The best incision is parallel to the transverse wrinkles of the neck. The deep fascia is divided, any intervening muscle freed and pulled to one side, and the gland exposed. Its capsule and usually a thin layer of its substance must be divided before the nodule is reached. Hemorrhage is readily controlled by clamp and ligature. The nodule is shelled out of its bed. The divided gland is sutured with fine, catgut sutures which pass through its capsule; and the deep fascia is similarly sutured, while the wound in the skin is sutured with fine black silk. Only when there is oozing from the gland should a small drain be employed.

The removal of a part of a diffusely enlarged thyroid gland is a much more serious matter and should be undertaken only after all precautions for a major operation have been made, and yet some of the most experienced operators use a local anesthetic in all cases of goiter. In no case should the whole gland be removed, as myxedema or other nervous disturbances are apt to lead to a speedy fatality.

ACQUIRED DEFORMITIES

Cicatrices.—Burns of the neck (p. 125) are often followed by annoying cicatricial contractions. Besides the disfigurement so caused, the force of the fibrous bands may keep the head twisted to one side or may bring the chin close down to the sternum (Fig. 87).

Treatment.—Such a condition of affairs may be greatly improved by a suitable plastic operation in some cases and in others by extensive skin-grafting (Chapter XX). If possible, the offending bands should be partially or wholly excised, as their presence will seriously interfere with the result of the operation. The exact details of such an operation cannot be given, as they must be made to correspond to the necessities of each particular case. It is well, however, for both the patient and the surgeon to recognize that the best results under such circumstances are obtained, not by a single extensive operation but by several lesser ones, repeated at intervals sufficiently long to reveal the gain made by each operative attempt.

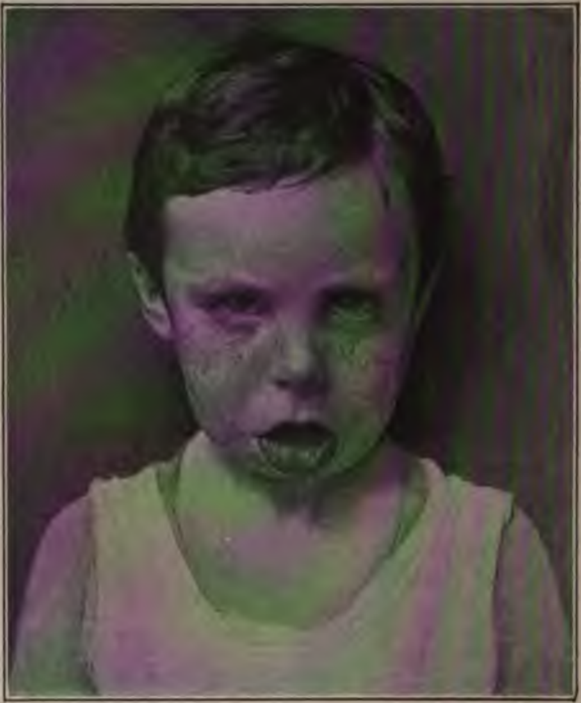


FIG. 87.—CICATRICIAL CONTRACTIONS FOLLOWING BURN OF THE NECK.

Torticollis, or Wryneck.—Wryneck, or torticollis, is the shortening of one or more of the cervical muscles, so that the head is held in an abnormal position. There may or may not be a spasm of these muscles. The sternomastoid is the muscle most affected, although the posterior cervical muscles are usually involved to a certain extent (Fig. 88). The condition is thought to be due to a unilateral myositis of infancy, secondary possibly to traumatism at birth, or developing as one of the lesions of congenital syphilis. As the child grows, the lack of exercise of certain muscles from the cramped position in which the head is constantly held, adds to the deformity and increases the muscular changes. If nothing is done to relieve the condition, the cervical spine will become much curved, and there will be compensatory curves in both the dorsal and lumbar spine. Even the development of the head may be affected (Figs. 89 and 90).

Strictly speaking, cases of torticollis may be divided into acute and chronic. Usually, however, the acute symptoms will have subsided before the child is brought to the doctor.

DIAGNOSIS.—In many cases the parent has already recognized the nature of the deformity. Inspection shows that the mastoid process on the affected side is nearer to the sternum than it should be. This means that the face is turned toward the opposite side and the chin slightly elevated, although the head may be bent toward the shoulder of the affected side. If the contraction is of long standing, the whole head will seem to have slipped over toward the unaffected side. This is due to the curvature of the neck. But the most reliable method by which to ascertain what muscles are affected is to make palpation and manipulation of the head and neck. When the head is flexed and extended, and abducted to the right and left and rotated, the difference in the muscles of the two sides of the neck is at once apparent. Such manipulation is usually not painful unless carried to an extreme degree.

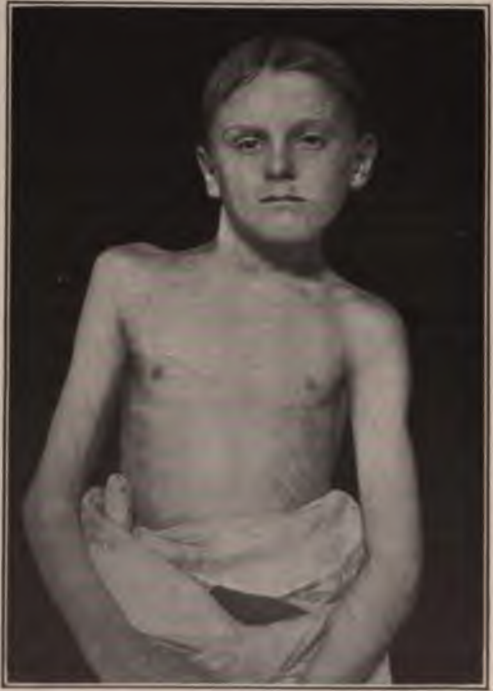


FIG. 88.—WRYNECK OF RIGHT SIDE OF MODERATE DEGREE. The position of the head is typical. This patient was made absolutely straight by an operation performed with cocain, and subsequent manipulation.

A differential diagnosis between torticollis and tuberculosis of the cervical spine has sometimes to be made. In tuberculosis there is extreme tenderness, inability to move the head in any direction without pain, spasm of the cervical muscles when an attempt is made to do so. Moreover, there is a daily slight fever.

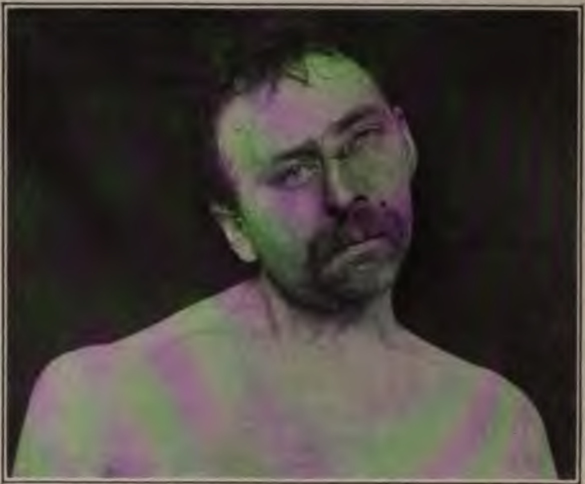


FIG. 89.—EXTREME DEGREE OF TORTICOLLIS, SAID BY PATIENT TO BE CONGENITAL. Note the deformity of face, as well as of spine. The ulcer of the nose was due to recent traumatism.

TREATMENT.—The first treatment of acute torticollis is the treatment of the traumatism or acute myositis in which it originates. This consists in the application of heat, and the mainte-

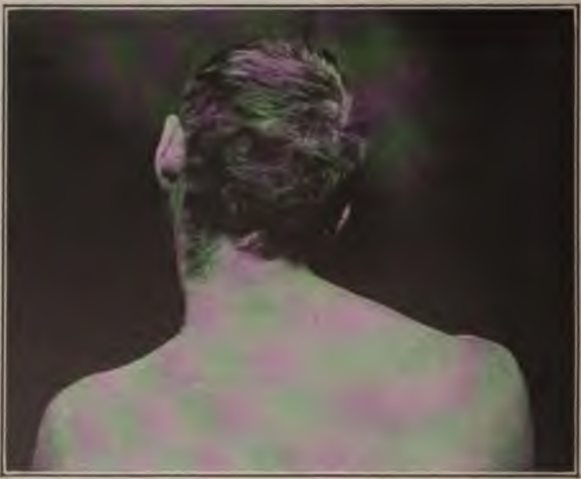


FIG. 90.—BACK VIEW OF SAME PATIENT.

nance of the head in a correct position, or at least the prevention of an increase in the deformity. If the condition is considered to be rheumatic, salicylate of soda should be administered.

As soon as the pain subsides, treatment by manipulation should be commenced to correct existing deformity. The effort should be to overcorrect the deformity which exists. Therefore the face should be rotated in the opposite direction until the affected sternomastoid is tight. The chin should then be tilted downward and the head bent away from the affected shoulder. These manipulations should be made a number of times, and the treatment repeated each day until the deformity is overcome. Even then it is better for the physician to see the child once a week for a few weeks.

If the patient is an infant, manipulation described may be carried out upon the mother's lap. If it is an older child, it should sit upright during the treatment. In either case it is an advantage if a second person holds the shoulders while the manipulations are made, so that the manipulator can make traction upon the head while twisting it and bending it.

During sleep the pillow should be so arranged that the position of the body will tend to correct the deformity, or at least will not tend to increase it.

In chronic cases, treatment by manipulation will succeed only if the affected muscles are still elastic; otherwise operative treatment is indicated. In slight cases, division of the sternomastoid muscle is necessary, whereas in the severer cases the trapezius splenius and other muscles will also require division.

The incision may be made parallel to the edge of the sternomastoid or parallel to the clavicle. The former leaves a slighter scar. The incision should be at least an inch long. Usually, when the most prominent bands have been divided and tension has separated their cut ends, it will be found that other deeper ones still hold the head to a lesser degree in an abnormal position. Such bands should in turn be divided until motion of the head is free. The restraining muscular bands lie a little outside the sheath of the great vessels, and the latter could be injured only by careless cutting. No deep suture is necessary. Hemorrhage should be stopped and the skin-wound entirely closed with fine black silk sutures. A firm dressing should be applied, and the head put up in an overcorrected position and held so by a plaster of Paris bandage placed around the neck, over the head, and un both arms (No. 22, Chapter XXI). If there is no rise of te perature or pain, the dressing need not be changed for a week ten days. As soon as the wound has healed, gentle passive ro tion and other motions of the head should be commenced a repeated every other day for several weeks. As the time goes the force with which this is done may be increased, and in additi the patient should practise active motion daily to correct the formity and increase the mobility of the neck.

SECTION III

AFFECTIONS OF THE TRUNK

CHAPTER VI

INJURIES AND INFLAMMATIONS OF THE TRUNK

INJURIES

Contusions of the Chest and Back.—Blows upon the chest and back on account of the firm underlying bones usually produce little injury. General directions for treatment of such injuries are given on page 2.

Contusion of the Breast.—A blow on the mammary gland may produce a partial rupture with the formation of a hematoma (Fig. 91; see p. 3 for treatment) or an inflammation, mastitis, or even abscess. It may also be followed by a malignant growth. Hence the importance of immediate intelligent treatment.

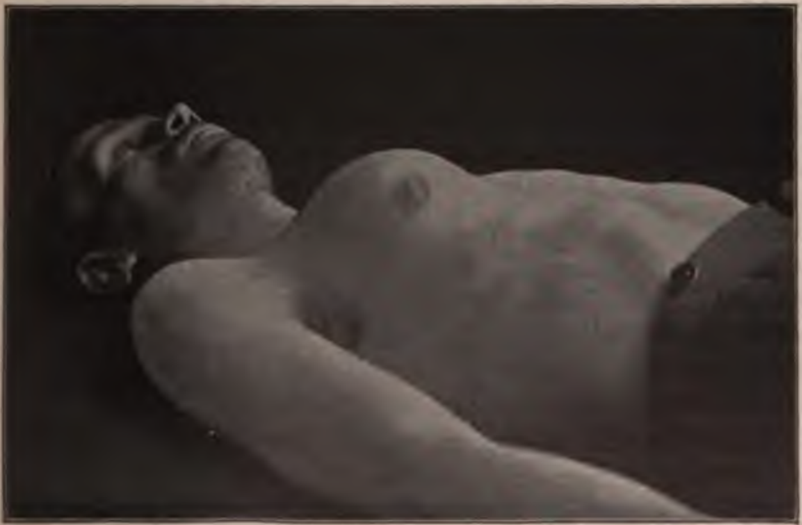


FIG. 91.—LARGE HEMATOMA OF MAMMARY REGION, FIVE WEEKS AFTER A BLOW.

Hot, moist applications should be applied to the breast, or the surface may be covered with gauze thickly spread with ichthyol ointment, and outside of this a layer of non-absorbent cotton or lamb's wool. Moderate, even pressure is to be maintained by a breast bandage, which should be so applied that the breast is supported from the shoulder (No. 28, Chapter XXI). After a few days gentle massage should be administered.

Contusion of the Back and Ribs.—Contusion of the back is considered under the heading Sprain (p. 158), and contusion of a rib under the heading Fracture (p. 167).

Contusion of the Abdomen.—Blows or undue pressure upon the abdomen are important less for their effect upon the abdominal wall than upon the abdominal organs, one or more of which may be ruptured or seriously injured by violence which leaves no mark upon the skin.

A sharp unexpected blow upon the abdomen is apt to produce a condition of shock which is familiar to every boy under the phrase "it knocked the wind out of him." The abdominal muscles being off their guard, the force of the blow is received upon the sensitive structures beneath, especially upon the sympathetic ganglia in the region of the solar plexus, and faintness and nausea and possibly vomiting and unconsciousness follow. Such a blow may even produce death, although this is not common in an anima the size of man. When the muscles are forewarned and have time to contract, they can protect the abdominal organs against a very heavy pressure. For instance, a man weighing, say, 170 pounds can lie face downward bearing his whole weight on a horizonta bar which crosses his abdomen. The rigidity of the recti and othe muscles prevents the bar from pressing backward enough to pinch the intestine or mesentery against the spinal column. This explains how so many persons escape serious injury from the whee of a moving vehicle, even though it passes directly across th abdomen. Such escapes have been frequently noted, even whe the vehicle has weighed more than 3,000 pounds (750 pound weight on each of four wheels). When the wheel is broad an rubber-tired, the possibility of escape from serious injury is naturally much greater than with a wheel having a narrow steel tire

Diagnosis.—The principal symptoms of contusion of the abdomen are general. They are the symptoms which, grouped togethe are spoken of as shock—namely, feeble pulse, pallor, cold, possibly clammy skin, and frequent respiration. These are also the symptoms of internal hemorrhage and of rupture of the stomach or intestine, which are often the result of undue force applied to the abdomen. It is important to separate simple contusion from these other conditions, if possible, since their respective treatments are opposites. Often the progress of the case will alone decide. If there is uncomplicated contusion, the symptoms will rapidly disappear. If there is an accompanying internal hemorrhage or rupture, the pulse and respiration will increase in rate, the patient will become more restless, and the symptoms of shock will become more marked. Vomiting usually accompanies rupture of an intra-abdominal organ. The vomitus should be examined microscopically to determine the possible presence of blood.

There is usually pain at the seat of rupture, extending thence in the direction in which the escaped intestinal contents would be likely to gravitate. If the amount of escaped fluid is large, its presence as free abdominal fluid may be shown by percussion with the patient lying first on his back and then on his side, or in other positions. Abdominal rigidity on palpation is a sign of great importance. It may exist in simple contusion, but it is less marked than it is in more serious conditions and tends to decrease.

In all cases of abdominal injury the whole abdomen should be carefully examined with the stethoscope. By this means one can determine whether the normal peristaltic action of the intestines is going on, whether normal peristalsis is at a standstill, and, roughly, the shape of the air-spaces which distend the abdomen, and the presence of free fluid or gas. All of these factors have their weight in determining the question of operation. If perforation of stomach or intestines is present, immediate operation and suture gives the patient the only chance of recovery. Under such circumstances the delay of a few hours will reduce such chance by at least one-half, as the successful cases are almost exclusively those operated upon within sixteen or twenty-four hours after the accident. The character of the urine, and the patient's ability to pass it, and the state of the bowels must also be considered, as rupture of the bladder or of one kidney is as urgent an indication for operation as is that of the stomach or intestines.

NON-OPERATIVE TREATMENT.—If it is decided that no serious internal injury exists, and in all cases, before a complete diagnosis can be made, the patient should be kept absolutely quiet in a horizontal position. An ice-bag or heat applied to the abdomen usually helps toward this end. It is desirable to avoid morphine unti the diagnosis is clear. If this is not possible, the doses given should be small, and should be administered hypodermically. Absolutely nothing should be given by mouth. If the skin is broken a light, moist, antiseptic dressing should be applied. The symptoms of the patient should be noted every hour. If they all improve steadily, it may be safely inferred that there is a simple contusion. If they grow worse, and particularly if local muscula rigidity is noted or increases, laparotomy should be performed It should be the aim of the surgeon to decide definitely for o against operation in less than twelve hours from the injury. Thi gives the patient the best chance of recovery after operation, whatever the character of the injury.

If the contusion is uncomplicated, the patient may be allowe water after twelve hours, fluid nourishment on the following day and solid food after the bowels have been moved.

It is well worth remembering that a contusion of the abdom nal wall may be accompanied by a contusion of the intestine without immediate hemorrhage or rupture. This is particularly ap to be the case after wheel injury. The slough of intestine ma give way and allow the intestinal contents to escape into the abdomen as late as two weeks after the injury. The warning sign i a localized contraction of the muscles of the abdominal wall. Th patient should be kept in bed and on the simplest fluid diet unt this disappears.

Wounds.—Uncomplicated wounds of the trunk should b treated in accordance with the rules given on page 13.

Hemorrhage from the Umbilicus.—This occurs in the infan due to premature separation of the cord. The hemorrhage shoul be controlled by solution of adrenalin (1 : 2,000) and pressure, o by application of peroxide of hydrogen full strength or dilute one-half, or if necessary by ligature. Asepsis should be observe in the dressing.

Gunshot Wound of the Back.—Gunshot wound of the bac as met with in civil life is frequently not serious, as the bulle of small caliber fired from cheap revolvers do not penetrate through the thick muscles in this region. A bullet fired into the back may be deflected by the strong fascial planes or by some vertebra; it is therefore difficult to make out its exact location or to follow its track with the probe. Unless its situation is easily determinable, the surgeon should recognize that the operation for its removal may be a protracted one, and should make preparation accordingly. If the bullet is within easy reach it may be extracted and the wound properly treated without a general anesthetic. The position of the bullet may be shown in a radiograph if the patient is not too stout.

Penetrating Wound of the Pleural Cavity.—A bullet or the point of a knife may pass between two ribs and open the pleural cavity. Air or blood may then occupy the pleural space. There may be more or less shock. If there is no wound of exit, an attempt should be made to locate the bullet by means of the X-ray. If the lung is injured there is usually a certain amount of cough and hemoptysis and an effusion of blood into the pleural cavity, revealed by an area of dulness on percussion; but even these symptoms may be very slight. If a large artery is broken, death follows rapidly, partly from hemorrhage and partly from suffocation, as the blood which pours into the bronchi is imperfectly coughed out.

TREATMENT.—Air or a small quantity of blood is readily resorbed from the healthy pleural cavity. Even a foreign body such as a bullet may give no trouble. It is best, therefore, not to explore a penetrating wound of the chest unless there is some definite reason for interference, such as the known accessibility of the bullet, continued hemorrhage, or the existence of suppuration (p. 175). Drainage is secured by the resection of two inches of one rib as described on page 177.

Penetrating Wound of the Pericardial Cavity.—A penetrating wound of the pericardium alone may be sutured under cocain after the excision of an inch or two of one rib, or the wound may be left to unite of itself. The danger in such a case is not from the extent of the injury, but from the possibility of subsequent inflammation. Drainage is inadvisable in a recent case, but if pus forms in the sac, extensive drainage will of course be required. If the heart is injured the case is by no means hopeless. Instances are on record in which after the resection of a portion of one or more ribs, the pericardial sac has been opened and the wound in the heart successfully closed by suture.

Penetrating Wound of the Abdomen.—Every wound of the abdomen should be explored until the surgeon can either see its bottom or can assure himself that it has entered the abdominal cavity. Whether it should be explored still further will depend on circumstances. It is generally agreed that the abdomen should b opened after every gunshot wound, and after every stab wound accompanied by symptoms of hemorrhage or intestinal injury. As t penetrating wounds without symptoms of complication, it may b said that the risk of opening the abdomen with suitable facilities is less than the risk of allowing the injury to go without exploration. The younger surgeons at least are acting on this principle

Sprains.—**Sprain of Back.**—As a result of twists and falls and less often of blows, the back is sprained, almost always at th junction of the lumbar and sacral regions. Often under such ci cumstances there is little or no change in its appearance; the usu symptoms are those of stiffness, and pain at the pelvic attachmen of one or both lumbosacral muscles, noticed especially when th position is changed after a short period of quiet or when a attempt is made to bend the body in certain directions. Som times it is almost impossible to stand erect. In the simpler case the symptoms are due to stretching or bruising of the muscles o of the intermuscular cellular tissue. In the severer cases it probable that some of the muscular or fibrous threads are broken at any rate, the symptoms often persist for a provokingly lon period, sometimes for several weeks.

It is not always possible to differentiate a sprain of the bac from lumbago. The latter is technically a neuralgia in the mu cles of the back, and usually comes on after exposure to cold. such exposure is combined with overexertion it may be impossib to tell whether the symptoms are due to sprain or to lumbago. the treatment is similar in some respects, the doubt is less impo tant than it would be otherwise.

Treatment.—The first indication for treatment is the reli of the pain. This may be constant, or occur only when the mu cles of the back are contracted. There may be a partial spasm the muscles which greatly aggravates the pain. The patient shou remain in bed while the symptoms are acute, and external heat should be applied. This may be moist or dry. A hot-water bag filled with boiling water is a convenient form of application. Hot moist compresses may be applied, covered with flannel, and still further heated by a flat-iron.

Massage is indicated, especially around the origin of the strong muscles of the back from the sacrum and ileum. The massage to be effectual must be given with a good deal of force; hence mechanical vibration with a good machine is most serviceable in these cases.

Dry-cupping is another means of relieving pain in this region which is not used nearly as often as it should be.

The various counter-irritants may be employed. No one is better, and none so cleanly, as the thermocautery. The point of the cautery, preferably a round one, should be kept at a pale red heat, and should be swung in circles which just touch the back tangentially. In this manner the cauterization can be performed with a delicacy quite impossible if a forward and backward movement be given to the point. The pain of this treatment is very slight if the point passes swiftly over the skin, so that the cauterization can be continued until the whole painful area has been thoroughly gone over. The treatment may be repeated the following day, if necessary. Sometimes a single application will effect a cure.

It is rarely necessary to give morphin. Acetanilid, or one of the other coal-tar products, is sufficiently powerful if an analgesic is necessary.

There is one other remedy which is said to stop the pain in lumbago almost instantly, and that is the injection of from four to twelve ounces of sterile normal salt solution into the muscles of the back.

In cases of sprain it is important to support the back and to keep the injured parts at rest. For this purpose a proper strapping with adhesive plaster is excellent. The use of a porous plaster is too well known to require mention. A far more efficient support can be obtained as follows: two strips of adhesive, three inches broad, are applied on either side of the spine from the lower angle of the scapula nearly to the tuberosities of the ischia. There should be a space of a half inch between them. Six transverse strips, each two inches broad, and long enough to reach a little more than half-way around the body, should cross these vertical strips at right angles (Fig. 92). There should be a space of half an inch to an inch between each one of these to allow the perspiration to evaporate and to lessen the itching which follows the application of a broad, unventilated strip of adhesive plaster.

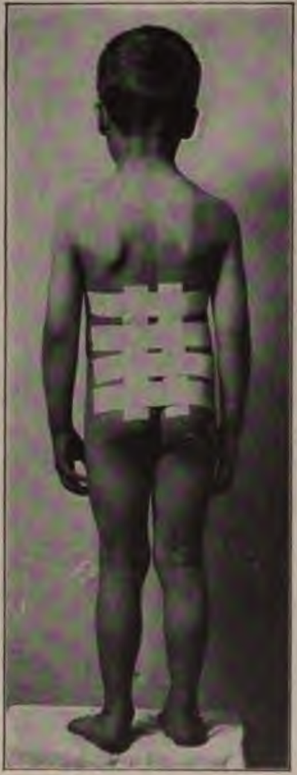


FIG. 92.—STRIPS OF ADHESIVE PLASTER APPLIED TO GIVE SUPPORT TO A SPRAINED BACK; GRIDIRON STRAPPING.

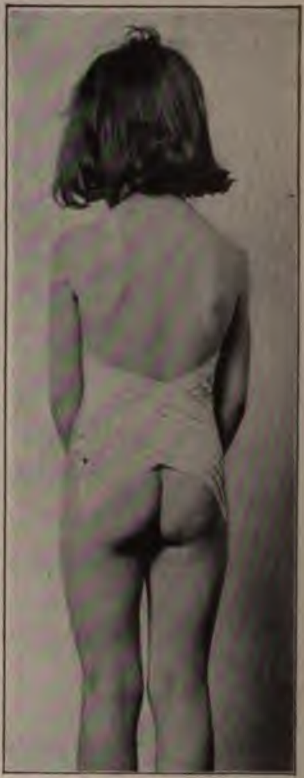


FIG. 93.—STRIPS OF ADHESIVE PLASTER APPLIED DIAGONALLY TO GIVE SUPPORT TO A SPRAINED BACK.

Another method of strapping is to apply the strips of adhesive plaster diagonally. It is easier to make the plaster fit a hollow back when it is applied in this manner (Fig. 93).

Whatever the method of strapping chosen, the patient should stand upright or lie prone on his face when the strips are applied, so that the back may be fully extended at the time. He should subsequently avoid bending forward, as that loosens the plaster and lessens its usefulness. The strapping should be repeated every two or three days, or as often as it loosens. The old plaster can be peeled off, or washed off with ether or benzin or " carbona."

In some cases the administration of the salicylates seems to hasten recovery. This is especially true in cases of lumbago.

Railroad Spine.—The effects of a severe contusion of the back or sprain of the spinal column are sometimes felt for months or years. It is important for the surgeon to know whether the symptoms complained of are real or are kept in the mind of the patient by an expected suit for damages. This doubt has earned for this type of injury the name " railroad spine." Without going into the remote details of this subject, it is worth while emphasizing one point. Whoever examines one of these patients should inspect

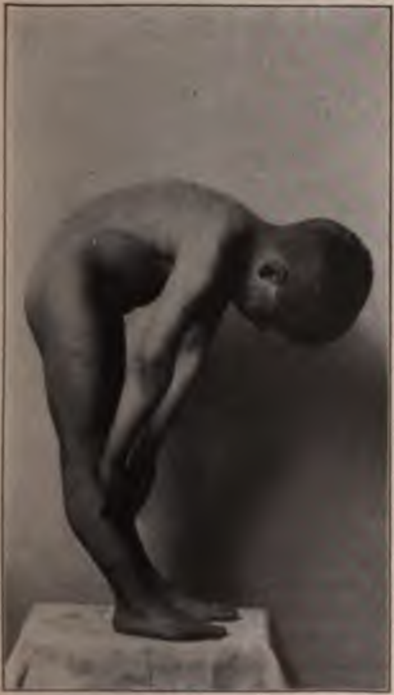


Fig. 94.—Tests for Injury of the Spine. The patient bends forward. Note the full normal curve of the spine.

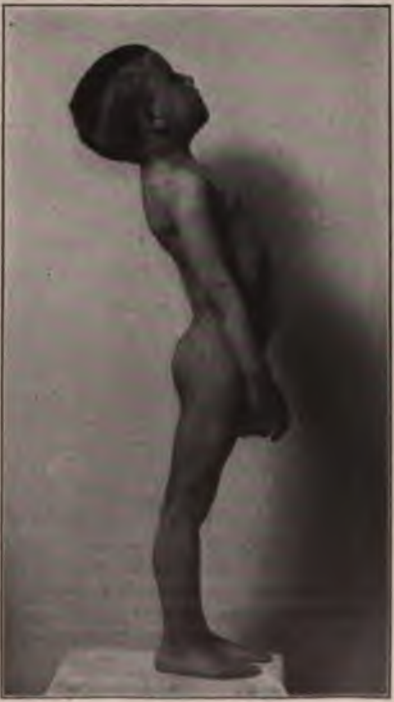


Fig. 95.—Tests for Injury of the Spine. The patient bends backward. Note the concavity of the dorsolumbar region. This attitude is impossible in sprain.

and palpate the back from the skull to the sacrum, and should then test the functions of the spine in the following manner: The patient should be stripped to the hips and stand erect with his back toward the surgeon. 1. He should bend forward and backward several times, keeping the knees straight, while the surgeon notes the flexibility of the different portions of the spine (Figs. 94 and 95). If any portion has been injured the muscles will hold it rigid while the other parts are bending. This is especially striking if one side is involved more than the other. This contraction of a part of the muscles of the back is something which cannot be imitated, and if present represents real injury. 2. The patient stands erect as before, and then, without flexing the knees, he bends his body toward the right and then toward the left, while the range of motion of the spine and possible irregular muscular action is noted as before (Fig. 96). 3. The patient, without mov-

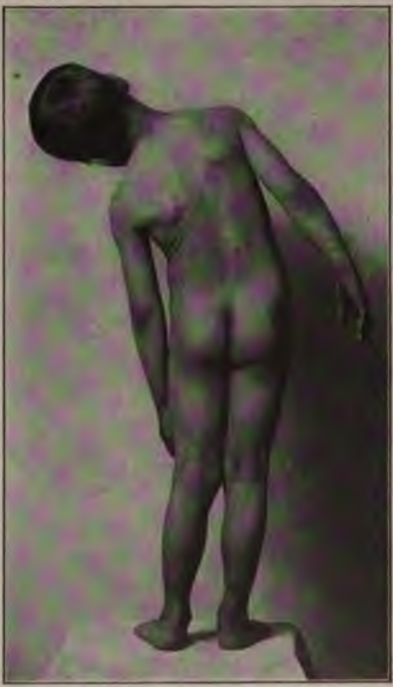


Fig. 96.—Tests for Injury of the Spine. The patient bends to the left, keeping the knees straight. The same motion should be made to the right.

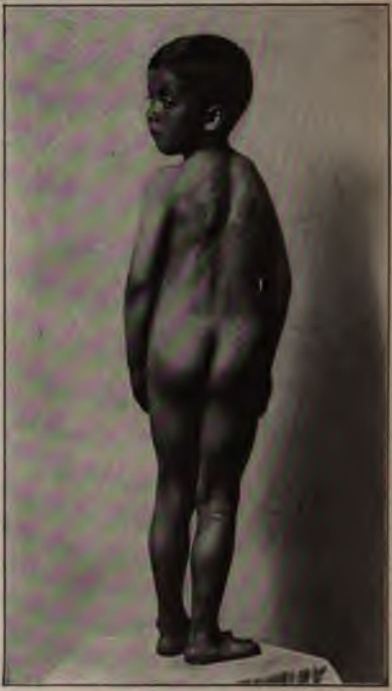


Fig. 97.—Tests for Injury of the Spine. The patient twists to the right and then to the left without moving the feet.

ing his feet on the floor, twists his shoulders around to the right as far as possible, and then around to the left (Fig. 97). The limit of motion in these various directions, and any other points observed, should be recorded for future comparison.

TREATMENT.—The treatment in these cases must be long continued to produce permanent results If tenderness is marked, the spine should be supported by a plaster of Paris jacket (Chapter XXII). In most cases it is better to obtain the support by a removable corset, so that there may be daily massage and exercises. Mechanical vibration is of great service. Out-of-door life and other hygienic measures are of the greatest importance. There is a strong tendency to hysteria in these patients, and the regulation of the daily life should be such as will lessen rather than increase this tendency.

Fractures.—**Fracture of Clavicle.**—Sometimes by direct violence, or more often as a result of falls upon the arm or shoulder, the clavicle is fractured. Any portion of the bone may be broken, but the line of fracture is in the great majority of instances within an inch of the center of the bone (Fig. 98). The normal outline is changed, due to edema and the irregularity of the broken bone. The amount of deformity varies greatly. The line of fracture

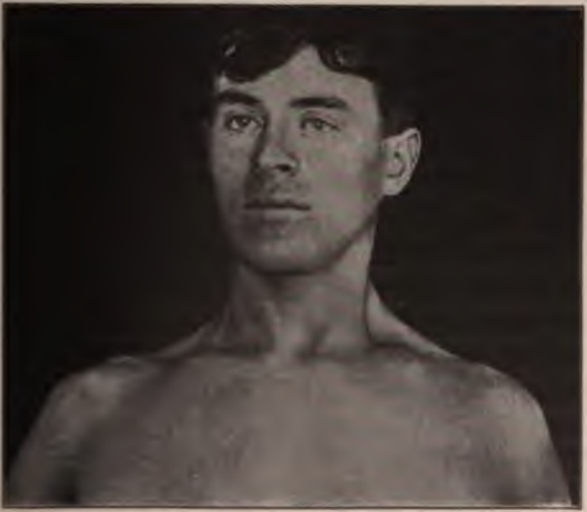


FIG. 98.—FRACTURE OF LEFT CLAVICLE IN THE USUAL SITUATION OF ONE WEEK'S DURATION.

is usually an oblique one, and either the outer or inner fragme
is displaced backward.

There is more or less disability of the arm, extreme motio
being limited by pain. In some cases measurement from the ste
nal to the scapular end of the bone will show a shortening, but th
is not always the case. There is a swelling and tenderness at t
site of fracture, and crepitus can usually be obtained, unless t
fracture is near the outer extremity of the bone. In that ca
motion between the fragments may be prevented by the vario
ligamentous attachments to the coracoid and acromion process
Ecchymosis is usually present, but is often slight.

TREATMENT.—On account of the impossibility of applying a
form of apparatus on both sides of the bone, treatment of a fr
tured clavicle, aiming to reduce the misplaced fragments and
keep them in position, is eminently unsatisfactory. This does
mean that a bad result is to be anticipated. On the contrary,
most cases the bone unites speedily, with little deformity, if
arm is merely kept in a sling. Many times some child's mot
has brought it for treatment two weeks or more after the
occurred, with not the slightest idea that any bone had b
broken. The pain disappeared a day or two after the accide
and she only sought medical advice on account of the slight sw
ing at the seat of fracture, or because the child still cried w
lifted by that arm. In these absolutely untreated cases ther
often union with a minimum of deformity.

If no deformity exists, or if it is slight, the patient sho
not be tortured with unnecessary apparatus. The arm sho
merely be supported in a sling, or if the patient is restless, o
a child, a simple bandage of the arm to the chest should be appl
A good bandage for this purpose is the Velpeau (No. 30, Cha
XXI). This method of treatment is adapted not only to frac
of the outer portion of the clavicle, but to many fractures in
central portion. Sometimes existing deformity may be lessene
pressure directly upon the projecting fragment, obtained by a
press of gauze and two strips of adhesive plaster crossed ove
in an X. This is only advisable in those cases in which sl
digital pressure has been found efficacious in replacing a fragm

There remain for consideration those cases in which defor
is considerable. The fracture is usually oblique and the fragm

have overlapped. If the fracture is recent, one can usually reduce the overlapping by grasping the upper part of the arm and pulling the shoulder outward and backward. But while this can be accomplished manually, and for a few minutes without pain, attempts to keep up this extension for two or three weeks are sometimes very painful, so that the patient wriggles until the pull is lessened, or, if he fails to do so, the skin where pressure is greatest may become excoriated. I have repeatedly seen instances of this in cases in which a Sayre's dressing has been applied.

Extension upon the Principle of the Lever.—There are two ways in which the shoulder may be pried out and backward by means of bandages alone. A pad may be placed in the axilla, and upon this as a fulcrum the humerus may be used as a lever. When the elbow is brought to the side the shoulder is pried outward. This is the principle of the antiquated Desault bandage (No. 31, Chapter XXI). Gradual flattening of the pad relieves the patient and does away with the extension upon the clavicle. The other method is that of the Sayre dressing and the Moore bandage. In the Sayre dressing the upper part of the humerus is fixed well back-

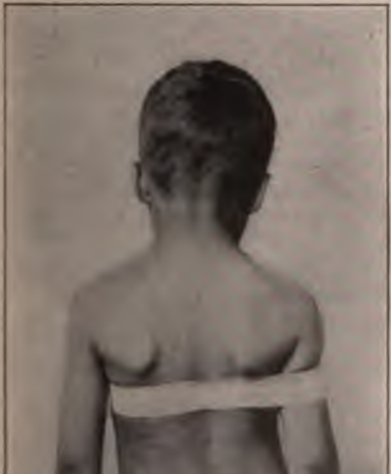


FIG. 99.—SAYRE DRESSING FOR FRACTURE OF CLAVICLE. Rear view. Showing application of first strip of adhesive plaster.

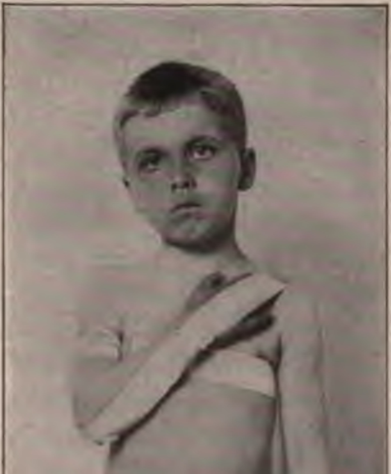


FIG. 100.—SAYRE DRESSING FOR FRACTURE OF CLAVICLE. Front view. Showing application of second strip of adhesive plaster.

ward by a loop of adhesive plaster about the arm and a continu tion of the same around the back and side of the chest, until is fastened to itself. The elbow is then pulled well forward a fixed by a second strip of adhesive plaster. The first loop ac as a fulcrum and the shoulder is carried backward (Figs. 99 a 100).

Moore's bandage acts on a similar principle, by pushing u ward the shoulder and drawing backward the arm by means of strip of cotton cloth twisted around the elbow in two directions.

Direct Extension by Means of Rigid Apparatus.—If a pr erly padded splint is placed across the back of the shoulders th may be bandaged or strapped to it, and thus extension of a brok clavicle be obtained with a minimum of pressure upon the s parts. A board used for this purpose is likely to slip unless is fixed by an upright piece. This makes a veritable cross, a few patients will consent to be bound to such an apparatus two or three weeks. It is, however, very efficient in reducing formity to a minimum.

Another plan which often succeeds is the application of posterior figure of eight bandage of the chest (No. 26, Chap XXI) in plaster of Paris. The bandage should be reenforced w a molded strip across the back of the shoulders, or a light woo splint may be incorporated in it.

Reduction by Operation.—Of course none of the methods extension above described is applicable unless reduction can accomplished manually without the employment of much fo In other cases, unless one is willing to allow union to take pl with deformity, it will be necessary to make an incision over site of fracture to bring the ends of the bone into a correct p tion, and to keep them there by means of a suture of chromici catgut or kangaroo tendon. It may seem like an unwarranta procedure to convert a simple into a compound fracture, but the experience of the writer the result obtained often justifies operation, as the bone will unite without deformity, and the s in a few weeks can scarcely be made out. Such an operation be performed with cocain if the patient is old enough to ap ciate the advantages of local anesthesia. The suture material ployed should be capable of resisting disintegration for at le four weeks.

Fracture of the scapula is far less common than that of the clavicle. If the fracture is of the body of the scapula or of its acromion process it is easily made out, crepitus usually being obtained by direct manipulation. No treatment is required other than limitation of the motion of the arm. Fracture of the neck of the scapula is a rare accident, whose exact diagnosis, like that of other fractures about joints, is most surely made by a good radiograph. The arm should be kept at rest for four or six weeks by a shoulder cap and sling (cf. No. 34, Chapter XXI).

Fracture of Sternum.—A severe blow is required to break the sternum. Even if this occurs, displacement of the fragments is unlikely. So that diagnosis depends upon the history, tenderness on pressure, and also on pressure at a distance, and in some cases on crepitus. If displacement has occurred, the displaced fragment may be lifted by boring into it with a coarse gimlet or a slender corkscrew. Once in place it will remain so without assistance. The front of the chest should be strapped with adhesive plaster to limit motion.

Fracture of the Ribs.—Fracture of a single rib is an extremely common accident. It usually is the result of a fall upon a sharp edge or corner. The ribs most exposed are oftenest broken. That is to say, the patient falls upon his side, striking upon the seventh, eighth, ninth, or tenth rib, and one of them is broken, usually in the posterior or anterior axillary line. Sometimes the rib is broken in two places two or three inches apart. There is usually little or no displacement of the broken ends. Pain, after the first feeling of injury has passed off, is not great, unless the patient coughs, laughs, or sneezes. The pain is apt to increase for a few days, since respiration constantly moves one broken end upon the other. To avoid this the patient breathes as much as possible with his sound side. He often loses some sleep, and is incapacitated for hard work for three or four weeks.

The symptoms due to fracture of the ribs are simulated by those which follow a blow from some sharp object. This may injure the periosteum, and possibly crack the bone, although definite signs of this are wanting. There is tenderness on pressure, and perhaps pain, although the pain will not be greatly increased by respiration nor by pressure upon the rib at a distance from the point of injury, as is the case in complete fracture. There is, after a few days, a slight, hard swelling close to the bone whic simulates a callus, but is of less extent, and the deformity is les than if the rib were fractured. The symptoms usually last fro one to three weeks.

TREATMENT.—The pain can be materially lessened by apply ing a broad strip of adhesive plaster directly over the broken ri A strip five or six inches wide and long enough to reach half-wa around the body, should be fastened posteriorly first and then b drawn strongly and slowly forward to the front of the chest an made fast by pressing it close to the skin. The more tight an smooth the fit of the plaster, the greater will be the relief to th patient. It is sometimes recommended that when one end of th plaster has been fastened, the patient shall expire vigorously whil the surgeon quickly draws the plaster tight and sticks it to th skin; but on the whole a more satisfactory result can be obtaine by a slower and more careful application in the manner describe It is better that the plaster should cover only the affected sid This leaves the well side free to expand without pulling upon th injured side, as is the case if the plaster extends all the wa around the body. If the skin is hairy it should be shaved befo the plaster is put on; otherwise the patient will hold the one wh removes the plaster in lasting remembrance, as most of the hai will be so firmly embedded in the gum that they will be pulle out by the roots with the removal of the plaster.

Fractures of the Vertebræ.—Owing to the closeness of the articulations to one another and to the ribs, the dorsal vertebr except the lower two or three, are rarely fractured by indirect vi lence. Fracture of the lower dorsal vertebræ and of the lumb vertebræ may follow a severe fall or blow or be caused by a bull or sharp instrument. In most cases the fracture of the bone overshadowed by the injury to the cord. As this does not exte below the first lumbar vertebra the prognosis is more favorab the lower down the seat of fracture. Life may be prolonged alm indefinitely even though the cord be seriously injured, but soon or later, in spite of the greatest care, the patient dies from sep due to the extensive ulcers of the back or legs, or to purule cystitis, or to pyelitis, caused by the unavoidable catheterizati

The immediate symptoms of fracture of a vertebra are pa tenderness, edema, and at least partial loss of motion and sen tion. Ecchymosis is usually slow in making its appearance. All of these symptoms may be present in severe cases of contusion without fracture. Signs due only to fracture are crepitus, the displacement of a spinous process, and angular deformity produced when the spine is flexed or extended. In cases in which there is great pressure upon the cord or destruction of the same, there will be inability to urinate or defecate, and loss of sensation and motion.

TREATMENT.—In a doubtful case of fracture the patient should remain in bed until tenderness has disappeared. After that the treatment given on page 158 is applicable. If there is a fracture without injury to the cord, a plaster of Paris jacket should be applied in an extended position. The patient may be allowed to get up in two or three weeks, but should wear the jacket for two months. After its removal he should be treated by massage and exercise, with plenty of rest in a horizontal position.

The treatment of fracture accompanied by injury to the cord is beyond the scope of this book.

Dislocations.—**Dislocation of Clavicle.**—The clavicle may be dislocated from the sternum. The tendency to displacement is not marked, and a pad upon the overriding bone, with light pressure obtained by adhesive plaster strips and a bandage, will usually prevent its recurrence. If this is not successful, a periosteal suture should be performed. Fixation by either method should be maintained for several weeks.

Dislocation of the outer end of the clavicle also occurs. The symptoms are usually slight. The end of the clavicle projects upward. It is easily reduced by direct pressure or by drawing the shoulder outward. This, together with absence of crepitus and the absence of shortening of the clavicle when measured from the sternum to the outer projecting end, will differentiate this injury from fracture; though fracture of the clavicle sometimes occurs without shortening. It may be treated in the same manner as dislocation of the inner end, but any form of apparatus usually fails to keep the end of the clavicle firmly down on the acromion. This can be accomplished by passing a long fine drill through the acromion and well into the clavicle, and leaving it in place for eighteen days. The operation should be carried out aseptically.

Dislocation of Costal Cartilage.— Sometimes the cartilage of the tenth rib may be separated from that of the ninth at its anterior end, and by its occasional slipping forward and backward give rise to a little pain. The radical treatment is the amputation of the anterior tip of the cartilage; or counter-irritants may be applied until the acute symptoms subside and the patient grows accustomed to the sensation.

Dislocation of Vertebræ.—Dislocation of either dorsal or lumbar vertebræ without fracture rarely occurs, and when it does so it is a partial dislocation in most cases. Attempts at reduction should be made under general anesthesia with great care (see p. 125). If successful, a plaster of Paris jacket should be applied.

ACUTE INFLAMMATIONS

Burns.—The burns which occur on the body or trunk present no especial characteristics. As the body is protected by the clothing, the heat applied, whether of flame, fluid, or vapor, usually affects a considerable area. An exceptional case is shown in Figure 101. This man was working in an iron foundry, with scanty clothing, when the steam in a wet mold exploded and spattered him with small drops of liquid iron.

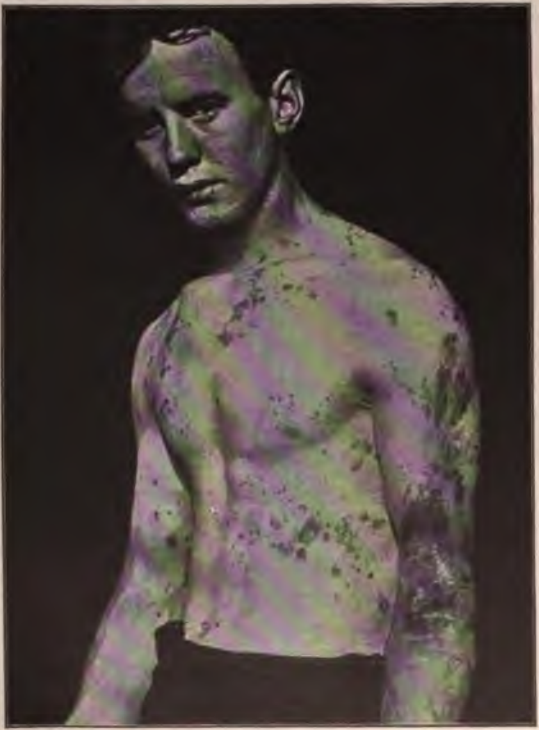


FIG. 101.—MULTIPLE BURNS OF BODY OF FIVE DAYS' DURATION PRODUCED BY SPATTERING LIQUID IRON.

TREATMENT.—Directions for th treatment of burn have been given o page 26. The immediate discomfor from burns of th body is less in proportion to thei area than it is in burns of the head and neck, and on this account one may be misled into making an unduly favorable prognosis. When the destroyed skin begins to slough the gravity of the situation will be more clear. Hence the importance of saving the strength of these patients in every way from the very first.

Insect Bites.—**Pediculi.**—By the marks of the nails one can usually make a diagnosis of pediculosis corporis. These body lice, which are vulgarly called "graybacks," live not upon the person of an individual, but upon his clothing. The marks of their bites are insignificant. The itching produced is extreme, and the patient has the habit of drawing his nails across the affected part of the skin in long sweeps. Minute excoriations of the skin often mark the track of these long scratches, many of which become infected, so that shallow ulcers result, which heal slowly, often with pigmentation. The diagnosis of the trouble can generally be made from the appearance of the skin. A search in the underclothing will result in the finding of pediculi. Essential treatment consists in the destruction of the parasites by baking or boiling the clothing, and observance of personal cleanliness. The itching often persists for days, so that an antipruritic may be indicated.

Fleas and Bedbugs.—The bites of fleas and bedbugs can usually be distinguished by their distribution. A flea travels quickly from one place to another, so that the bites of a single insect, from six to twelve or more in number, will often be scattered over half the body. A bedbug, on the other hand, makes numerous bites in one locality. These are often strung out in a row like the splashes made by a flat stone when it is skipped over smooth water. It is sometimes difficult to distinguish a bite from the lesions of urticaria. If the latter have not been scratched, the skin involved will not show any break; whereas the skin of a bite made by a flea or a bedbug will invariably show in its center a small puncture.

TREATMENT.—As infection is often caused by scratching an insect bite, it is important to relieve the itching. A solution of camphor in alcohol, or some other cooling lotion, is good for this purpose. Another excellent method is to brush the involved skin lightly with a whisk-broom or a not too stiff hair-brush. This relieves the itching without breaking the epidermis.

Scabies.—Scabies is also accompanied by itching, so that the excoriations may obscure the burrows of the insect. A minute examination of the skin will usually reveal the characteristic little row of brownish specks (the fecal masses of the insect) in the substance of the more or less inflamed skin. If the lesions are found on the hands, the differential diagnosis from pediculosis corporis is certain, as the body lice do not bite the exposed parts of the body.

The treatment of scabies consists in the disinfection of the clothing, and a hot bath at night, followed by a thorough rubbing of all suspected portions of the skin with sulfur ointment. In the morning another bath with soap and water should be taken. After three or four days, if patches of the disease remain, the skin should be treated again in the same manner.

Herpes Zoster.—This disease, on account of its predilection for the area of the intercostal nerves, may be here considered. It develops rather suddenly with pain and some fever, followed by an eruption of groups of small vesicles. Often the skin supplied by a single nerve is affected; sometimes that by two adjacent nerves; rarely that supplied by two opposite nerves, making it bilateral. It runs a natural course to termination with drying up of the vesicles in a few days, but in the meantime, by the burning and pain, it may make the patient very uncomfortable.

Treatment.—The vesicles should be protected from rupture. The burning may be relieved by the frequent application of a solution of menthol in alcohol, twenty grains to the ounce. Morphin may be required to control the pain in some cases.

Cellulitis and Dermatitis.—Cellulitis, erysipelas, and the various local suppurative processes occur frequently upon the trunk. In so far as they have no peculiar characteristic due to their situation, the description of them and the treatment given on pages 33 *et seq.*, must suffice. Only a few special forms of inflammation will be described in this section.

Excoriation of the Breast.—In stout women the constant contact of the skin of a pendulous breast with that of the abdomer may lead to excoriation, ulcer, or even abscess. These conditions rapidly disappear under suitable treatment. As a preventive the parts should be bathed frequently, the skin rubbed with alcohol and dusted with a talcum powder. If an ulcer has formed, we dressings should be employed.

Mammary Abscess.—The common period for the occurrence of an abscess of the breast is during early lactation, and especially the first lactation. The infection takes place through a crack or excoriation of a too tender nipple, and this can almost always be found upon search. The usual signs of suppuration are present. A portion of the mammary gland and the overlying skin are indurated and tender, and in the center of this affected area there can usually be made out a smaller area of fluctuation.

TREATMENT.—If the inflammation is seen at an early stage, wet applications should be made to the nipple and breast, either cold compresses, or flaxseed poultices, or wet compresses with heat applied externally, as spoken of in connection with abscess of the head (p. 38). A baby should not be put to the inflamed breast, although he may continue to nurse from the opposite one if the mother has only a slight degree of fever. The milk should be drawn regularly from the affected breast, and if in a day or two it is seen that the inflammatory process is increasing, an incision should be made into the center of the indurated area, where, as above stated, a soft spot can usually be felt. If the softened area is plainly palpable, it is useless to further postpone operation. The incision may be made under local or general anesthesia. It should invariably be made in a line radiating from the nipple. Neglect to observe this rule has led to the division of milk ducts and the establishment of a mammary fistula.

An abscess of the breast has a strong tendency toward recovery, and the incision therefore does not need to be much longer than the diameter of the suppurating area. The cavity should be thoroughly washed out with a solution of bichlorid of mercury, 1 : 2,000, and a dilute solution of peroxid of hydrogen, one part to five. A drain should be inserted in the abscess-cavity, but it should not greatly distend it. The hot, moist, gauze dressing should be continued. Under these circumstances any further secretion of pus quickly finds its way into the dressing, and the wound has an opportunity to heal just as rapidly as it is able to do so. Not until the repair has reached the subcutaneous fatty tissue should the drain be omitted.

Often in an abscess of the breast which has lasted for some time, so that the zone of cellulitis about the pus cavity is not an excessive one, incision and cleansing will terminate the whole pathological process so that the sides of the cavity will adhere and almost primary union of the wound will follow. If this rapid method of cure be attempted, the dressing should be changed at least every day, and if there is any retained discharge, the cavity should be washed out again and the drain inserted to a greater depth.

If the suppuration is more excessive and has passed beyond the capsule of the gland and has lifted up, as is frequently the case, a portion of the gland from the underlying ribs, more than one incision may be necessary to provide suitable drainage. Under such circumstances, one incision should be made at the most dependent portion of the abscess-cavity as the patient lies in bed or as she sits up, according to circumstances. If she is up most of the time, the most favorable point for drainage is immediately below the breast, whereas if she is lying in bed the outer edge of the breast or a point between this and the lower edge will be found most serviceable. If the pus shows a tendency to approach the surface at any point, that place should be selected for one of th incisions, as there are other factors connected with perfect drainage besides the force of gravity, and unless there are plain contraindications the point chosen by nature for the discharge of pu had best be accepted by the surgeon as the most suitable one.

The best drain for these cases is made by cutting the tip fron a rubber finger cot and passing through it a wick of gauze. I this manner the gauze will be prevented from sticking to the side of the wound. The rubber is more flexible and stronger than th gutta percha tissue usually employed in a " cigarette " drain.

Preventive Treatment.—The physician who has charge o a pregnant woman should give her directions for the enlargemer and toughening of the nipples by daily massage, applications c alcohol, alum, etc., and if they are retracted they should be draw out with a breast-pump. In this manner they can be prepared f nursing two or three months before the birth of the child, an cracked nipples and mammary abscesses can almost invariably avoided.

Axillary adenitis and suppuration are described in Cha ter XV.

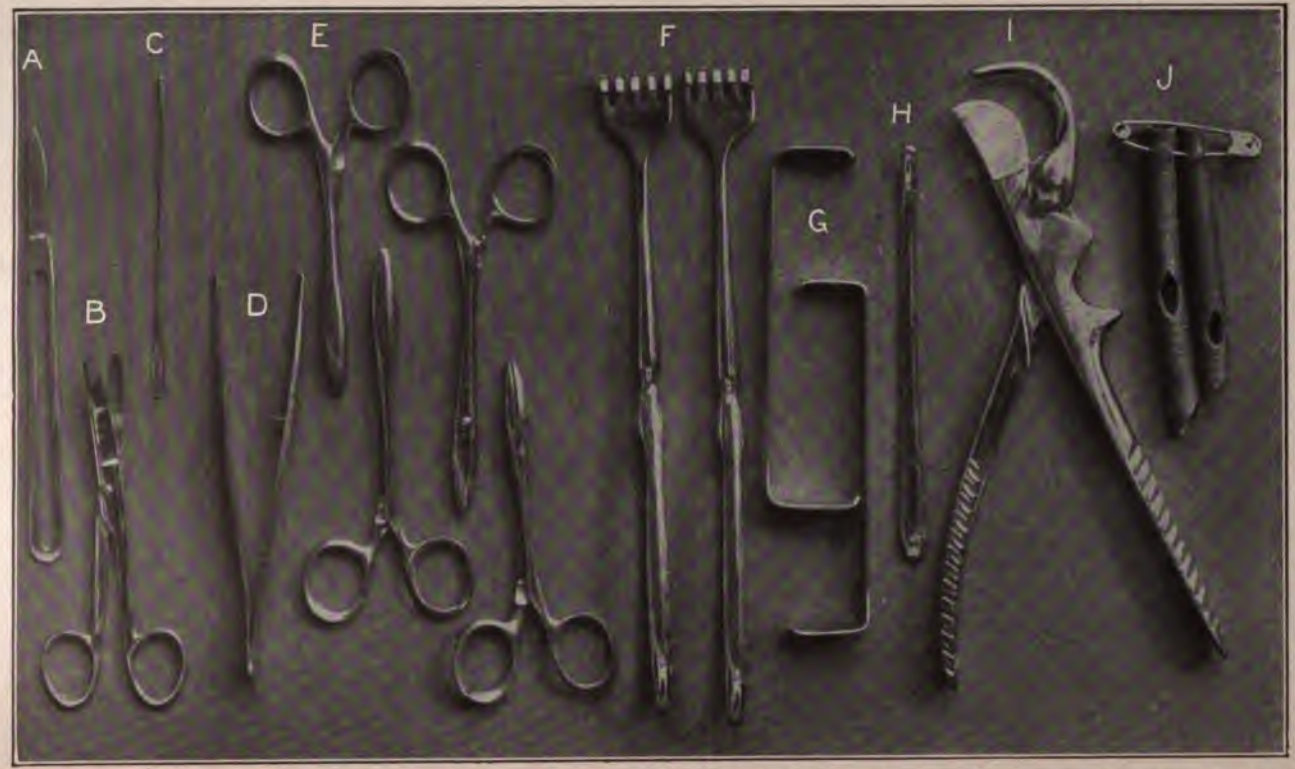
Inguinal adenitis and suppuration are described in Cha ter VIII.

Umbilical Suppuration.—The skin of the umbilicus may ulcerate or an abscess may form as a result of the irritation which is produced in a deep umbilicus by the dirt and secretions which may collect there, and even form a hard ball. Cleanliness and moist antiseptic dressings will speedily effect a cure. Umbilical sinus, which may also suppurate, is described on page 181.

Bed-sores.—An ulcer of the skin of a bedridden patient caused by pressure upon some one point is called a bed-sore. The sacral region is the commonest situation, both on account of its poor blood-supply and the habit many patients have of lying the whole time upon their back. There is first a dusky redness over the area about the size of a quarter of a dollar, then the epithelium gives way at the center and a sore is started which gradually involves the whole thickness of the skin, or possibly the whole thickness of the skin is at once involved and becomes dark and gangrenous and sloughs leaving a large ulcer. The skin over the great trochanter is also often the seat of a bed-sore. The rapidity with which a bed-sore may form, especially in a patient weakened by long disease, is truly amazing.

TREATMENT.—Frequent massage and the use of alcohol will usually prevent the formation of an ulcer if the weight of the body is supported upon soft pillows or an air-ring, so that the pressure upon the bony prominences is avoided. When an ulcer has formed, it should be washed frequently with mild antiseptics and dressed with a mildly stimulating preparation. Compare the treatment of ulcers of the leg, given in Chapter XVIII.

Empyema.—Pus in the pleural cavity, or empyema, is a condition demanding surgical treatment. The signs of empyema are fever, increased pulse and respiration, dulness or flatness in the lower portion of the affected side of the chest, above which is usually a zone of bronchophony with pleuritic râles. The diagnosis is not always an easy one to make, and the importance of prompt drainage is great, so that in a doubtful case it is better to make one or more exploratory punctures in order to be certain of the presence and the location of the pus. These punctures should be made with a large hypodermic needle. The needle used by veterinary surgeons for hypodermic injection is just right for the purpose. The syringe need not be a large one; an ordinary hypodermic syringe is large enough.



A, scalpel; B, scissors; C, probe; D, mouse-tooth forceps; E, artery

TREATMENT.—When pus has been shown to be present in the pleural cavity, drainage should be accomplished by the removal of an inch and a half of the eighth or ninth rib in the posterior axillary line. The operation may be performed under a general anesthetic, but if the respiration is embarrassed by the amount of fluid in the pleura, a local anesthetic is safer. The instruments required are shown in Figure 102. The soft parts overlying the rib are cut through parallel to its long axis for a distance of two or three inches, the scalpel being pressed firmly against the rib so as to split its periosteum. This is then reflected above and below, and bone shears passed between the inner portion of periosteum and the rib. An inch of the rib is removed and its cut edges trimmed if rough. The pleural cavity is then opened in the long axis of the rib, and when most of the pus has escaped two soft-rubber tubes pierced by the same safety pin are inserted. A stitch at either end of the wound is an advantage. A dry creolin gauze dressing is applied and changed as often as it becomes moistened by pus. . Forced expiration should be practised as soon as the soreness of the wound has somewhat subsided, say by the fifth day. The patient is shown how to blow colored water from one Wolff bottle to another. This exercise should be kept up for five minutes, and repeated several times a day. It is of the greatest service in stretching the collapsed lung so as to make it resume its normal space in the pleural cavity. The force of expiration can be increased by elevating the second bottle a few inches.

Drainage with two tubes should be continued until granulations have shut off the pleural cavity from the wound. The tubes may be shortened a half inch at a time as the cavity grows smaller, but they should not be removed as long as they enter the pleural cavity; nor should they be replaced by tubes of smaller caliber. Neglect of this rule has turned acute cases into chronic ones and made secondary operations necessary to reestablish drainage.

CHRONIC INFLAMMATIONS

Syphilis.—The trunk has its full share of the secondary and tertiary lesions of syphilis. An isolated gumma, appearing long after all other manifestations of the disease have disappeared, is often a puzzle in diagnosis. A common seat for the same is the region of the sternum. The constitutional treatment is important Any protective dressing will answer locally.

Tuberculosis.—Tuberculosis involves the skin of the trunk and especially of the back (lupus). Its essential characteristic are the same as those of the disease when seated in the skin o the face (see p. 63). Because of the concealed situation, mor radical excision and skin-grafting are permissible.

Tuberculosis of the bones and joints of the trunk is so fully di cussed in larger works upon surgery and orthopedic surgery that will be considered here chiefly for the sake of early diagnosis.

Tuberculosis of the Sternoclavicular Articulation.—This joi is attacked by tuberculosis as well as by syphilis. In either ca the periarticular tissues are swollen. In tuberculosis, one or mo tender spots in the end of the clavicle can usually be made ou Later an abscess may form and rupture.

If treatment by fixation is determined upon, it is easily secur by keeping the arm bandaged to the chest and carrying the for arm in a sling.

Costal Tuberculosis.—One or more ribs may be attacked tuberculosis. The general health of the patient suffers little, that the disease may be disregarded for some time. When t patient first comes for examination, there may be an abscess or sinus, the pus having already broken through the skin. A pro will follow such a sinus obliquely to the eroded bone. The fing will recognize that beyond the abscess-cavity the periosteum thickened. More than one rib is often involved, the extent of t disease being greater in one than in the other. Erosion of t inner surface of the rib is usually more extensive than that of outer surface.

Operative treatment is strictly indicated, and should be c ried out under general anesthesia. An incision should be ma over the affected rib parallel to its long axis, and the diseased bo periosteum, and other tissues fully removed. This can usua be accomplished without opening the pleural cavity, so that shock of operation is slight. The wound should be fully drain Recovery from the operation is prompt, but the patient should kept under observation for a considerable time, as extension the process along the same or adjacent ribs is the rule rather t the exception.

Tuberculosis of the Vertebræ.—The symptoms of tuberculosis of the cervical vertebræ have been given on page 133. When the disease is situated in the dorsal or lumbar vertebræ, the symptoms elicited vary somewhat according to the accessibility of the parts to palpation, and the varying degrees of motion that are their normal possession. An essential to diagnosis in every case is a thorough examination of the whole back, stripped to the skin for the purpose. Such an examination will almost always enable the surgeon to state positively, even in the early stages of the disease, not only that the spine is affected, but that the disease is situated in certain vertebræ. The various symptoms to be observed are: Slight edema along the spinous processes, slight deformity (which often disappears entirely in some positions), tenderness when the affected vertebræ are pressed upon (a sign often absent in children who cannot or will not differentiate pressure upon one vertebra from that on another), and rigidity or a lack of freedom in using the affected part of the spine. Compare the tests for sprain of the back given on page 162. A symptom which is chronologically a late one, but which is sometimes the first thing a patient notices, is the swelling due to an abscess. This may be situated near the spine posteriorly or it may come to the surface at the side of the trunk, or following down the front of the spine it may appear above or below Poupart's ligament.

TREATMENT.—As is well known, the treatment for a tuberculous focus which cannot be removed is immobilization, and relief from pressure. In the case of the spine these objects are partially obtained by a plaster jacket or a brace, and more perfectly obtained by a stretcher frame, a form of apparatus especially adapted to a child of four years or less.

Sacroiliac Tuberculosis.—Another common seat for tuberculosis is the sacroiliac synchondrosis. The difficulty of recognizing the disease in this situation is great, so that a correct diagnosis is often not made for a long time. A history of traumatism is apt to be confusing; the traumatism may have caused the trouble or be entirely independent of it. In either case it is apt to mislead the surgeon into thinking that he has to do with a severe sprain. The early symptoms are pain, slight fever, and a disinclination to exertion. As there is practically no motion between the ilium and sacrum, the best sign of tubercular joint disease, namely, limitation of motion, is in this case wanting; yet the patient moves with awkwardness and unusual care when he is asked to stoop, rise sit, squat, etc. If there is no history of injury the diagnosis o rheumatism is apt to be made. The age of the patient, the limitation of the trouble to a joint to which rheumatism is rarely i ever confined, and the slight but constant afternoon fever, serv to differentiate the two diseases.

TREATMENT.—In tuberculosis, of course, no benefit follows th administration of salicylates. Treatment is eminently unsati factory. Cases have been recorded in which an early resection o the joint has led to recovery, but owing to the fact that a diagnosi is usually not made until pus appears either in the groin or i the buttock, the most favorable period for radical treatment ha already passed, so that operations are usually palliative, to affor a more direct exit for the pus and so to relieve the patient of pai and some fever. The usual course is a steady decline through som years to death, unless the resisting power of the patient can b raised by hygienic measures.

Tuberculosis of the Mammary Gland.—One of the less commo situations for tuberculosis is the mammary gland. Because of i rarity, and because of the similarity of the lesion in its gener outline to carcinoma of the breast, this mistaken diagnosis is oft made. There will generally be a history of tuberculosis in th patient, or examination of the corresponding lung may show th the primary trouble was located within the chest and has work outward. If an ulcer or sinus exists its appearance will keep a observant man from making a wrong diagnosis. There will be the edges of the tubercular ulcer none of the active growth whi is always seen in the edges of a carcinomatous ulcer. The axi lary glands are usually enlarged if an ulcer exists.

TREATMENT.—In tuberculosis of the breast it is quite unnec sary to remove more than the affected part. Usually the who gland is diseased at the time of operation, but unless the axilla glands are plainly diseased it is wrong to subject the patient the extra shock of an axillary dissection. On account of the p sible involvement of an underlying rib, a general anesthetic preferable. If the disease is plainly limited to the freely movab breast-gland, a complete removal can be satisfactorily effect under local anesthesia if the patient's temperament warrants it.

CHAPTER VII

TUMORS AND DEFORMITIES OF THE TRUNK

TUMORS

CYSTIC TUMORS OF THE TRUNK

Sebaceous Cysts.—These cysts occur less often upon the trunk than upon the head. They are very rare below the waist line. They have the same characteristics as those of the head (p. 66) and require the same treatment.

Umbilical Cysts and Sinuses.—It sometimes happens that the duct which in fetal life leads from the umbilicus to the bladder, and which is called the urachus, is not completely closed at birth. Or it may be closed in part. As a result there may be a sinus discharging urine, or a short sinus with a slight discharge of sebaceous material, or a cyst lined with epithelium and containing sebaceous material. Or it may have no external orifice and may first manifest itself as a tumor situated below the umbilicus and containing sebaceous material.

TREATMENT.—The cyst or sinus should be removed by dissection through an elliptical incision made close around it. In some cases this is very easy; in others it is necessary to open the peritoneum for a short distance. As it is impossible to know this beforehand, the operation should be performed with extreme aseptic precautions. When the cyst or sinus has been removed, the abdominal wall should be closed in three layers—peritoneum, deep fascia, and skin—in order to prevent hernia. As the condition is an annoying one, rather than one which interferes with healthy development, the operation may be safely postponed if the patient is an infant, until it is some years old.

Coccygeal Cysts and Sinuses.—These formations are congenital in origin, but they may not be noticeable until adult life. In their simplest form the skin at the lower end of the spine is so folded in upon itself that it forms an isolated cyst lined with epithelium, or a sinus also lined with epithelium, on or both ends of which reach the surface of the skin. As the epithelium contains hair-roots, such a cyst or sinus is likely to fill u with sebaceous material and short hairs. If near the surface th contents may discharge from time to time. Such a cyst or sinu is usually situated low down in the median line over the coccy or sacrum. It is likely to become inflamed from time to time With the discharge of a mixture of sebaceous material and pus the acute signs of inflammation subside.

TREATMENT.—To rid the patient of this annoying conditio the cyst or sinus should be fully exposed by a median incision an all traces of an epithelial structure removed. The wound ma then be closed by suture, and primary union be anticipated eve if acute infection is present; although, if the infection is marke it is advisable to drain with a wick of rubber tissue some portio of the wound. At the change of dressing on the first or secon day this should be removed, and if the inflammation has subside it should not be reinserted. The operation is readily performe under local anesthesia.

Dermoid Cysts.—There are other dermoid tumors in th region of the coccyx which may contain, in addition to sebaceou material and hair, fragments of bone and other structures, or eve fairly well developed portions of another fetus or twin. The should be removed and the gap closed by a plastic operation o by skin grafts.

CYSTIC TUMORS OF THE BREAST

Retention Cysts of Infancy.—An infant's breast som times secretes a milky fluid, which collects in the larger duct about the nipple, and forms a soft fluctuating swelling. If th secretion is forcibly expressed from the nipple once or twice th swelling will disappear.

Retention cyst in the adult may be due to scar tissue, fo lowing abscess of the breast, or perhaps a misdirected incisio It will usually not be necessary to excise such a cyst. If i is split open and drained the normal granulations will obliterate its cavity. (Compare the description of a salivary cyst o page 71.)

Simple Cysts and Cystic Adenomata.—Cysts of the mammary gland apparently due to disordered secretion are very common in young women. Such a tumor is freely movable, rounded, and elastic; but it is very difficult to obtain fluctuation in it on account of its small size. It cannot always be differentiated from a solid tumor, except by aspiration. Moreover, the withdrawal of fluid does not absolutely distinguish the two, as many adenomata and some malignant tumors contain cysts. Naturally, in such a case, the withdrawal of the fluid will not so collapse the tumor as it will a simple cyst. The fluid may be like serum, straw-colored, or it may have a pink, red, or brown tint.

TREATMENT.—Aspiration as a means of diagnosis has been spoken of. It sometimes cures the patient, the fluid not again accumulating. Should this happy result not follow, or should the withdrawal of fluid not cause the immediate collapse of the tumor, operation is indicated. Small tumors can be removed from the breast under cocain; but on account of the sensitiveness of the part, and of the patient, a general anesthetic is better in most cases. If the operation is a short one the patient can rise and go home in a few minutes. It is well to bear in mind that a small, easily movable tumor seems much nearer the surface during palpation than it does when one is cutting through skin, fat, and fascia and an outer layer of the mammary gland in the search for it. It is a help to have the assistant seize the gland on either side and stretch the skin tightly over the tumor while the incision is being made.

The incision itself should radiate from the nipple. So much of the mammary gland as contains the cyst should be removed by an elliptical or a pie-shaped incision. The wound in the gland should be closed by catgut sutures, and the wound in the skin should be closed by silk sutures. No drainage should be used, or at most a small wick of gutta percha tissue introduced through the skin to provide for the escape of blood.

SOLID BENIGN TUMORS OF THE TRUNK

Granuloma of the Umbilicus.—Excessive granulation sometimes follows the removal of the stump of the umbilical cord. Owing to the confined situation the mass of granulations gradually assumes a polypoid shape.

Treatment.—This condition is easily cured by the application of a drop of pure carbolic acid on a wooden toothpick. A slower but safer and no less certain method is the daily application of undiluted hydrogen peroxid upon a minute cotton swab. This method is preferable if the point from which the granulations spring is so hidden by folds of fat that it is not readily brought into view.

Intra-abdominal Complications.—In rare cases a polypoid tumor of the umbilicus is covered with mucous membrane; or it may be lined with mucous membrane and communicat with the intestine. It should be removed, but not until on has at hand sutures to close a possible opening into the intestine, and others to close a gap in the abdominal wall i necessary.

Keloid.—This firm, smooth tumor occurs in scars, especiall in those of the trunk. It is made up of fibrous tissue, is intimately connected with the corium, projects a quarter of an inc more or less above the level of the skin, and is covered with shiny epithelium of poor quality, in which dilated vessels ar often seen. At an early stage of its development it cannot b told from a hypertrophied scar. As time goes on, however, th hypertrophied scar tends to shrink and lose its pink color, whil the keloid maintains its size or continues to grow, exceeding th original limits of the scar, and sometimes sending out prolongations into the skin around, which have been compared to crab claws, hence the name *keloid.* When a keloid develops in a woun which has been sutured, the scars of the individual stitches sometimes give rise to a greater growth than the line of incision itsel The skin of the negro is peculiarly susceptible to the formatio of keloids.

Treatment.—Surgical ingenuity has not yet succeeded i evolving a generally successful cure of keloid. Individual cure by various means have been reported, by dissection, by caustic by long-continued elastic pressure, and by the X-ray. If the original scar was a bad one, and the surplus skin in the vicinity permits of a complete dissection, with suture of the wound and probable primary union, this plan is worth trying. The suture shoul be an intracuticular one, or the interrupted stitches of fine sil should be removed at the earliest possible moment, about fou days. Tension upon the new scar should be prevented by cross strips of adhesive plaster for several weeks. But even when all these precautions are taken recurrence often follows.

Papilloma: Fibroma: Fibrolipoma.—These names are given to pedunculated tumors of fat and fibrous tissue covered with essentially normal skin. They vary in size from that of a pin-head to one inch or more in diameter. Frequently the tumors are multiple. The pedicle is usually small, but always contains an artery of a size corresponding to the size of the tumor. In this respect they differ from lipoma in which the blood-supply is very scanty (Fig. 103). A papilloma is a strictly benign growth, but on account of the annoyance caused by it, and its tendency to increase in size, it had best be removed.

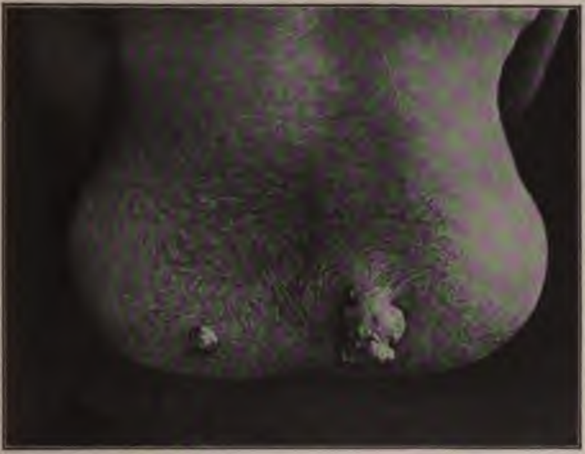


FIG. 103.—FIBROLIPOMATA OF THE BACK, OF FIVE YEARS' DURATION. Patient a girl aged nineteen years.

TREATMENT.—A small papilloma may be snipped off even with the surface of the skin with a pair of scissors. A larger one should be removed by an elliptical incision close to the base of the pedicle, made through the whole thickness of the skin. Such a wound when sutured will give the minimum of deformity.

Lipoma.—Lipoma of the trunk is relatively common, especially upon the shoulders. Such a tumor is lobulated, and while growing in the layer of subcutaneous fat its septa are intimately adherent to the skin. Hence the skin is dimpled when an attempt is made to lift it from the tumor. This is one of the diagnostic signs of lipoma of the simple subcutaneous type. It is well encapsulated by thin planes of connective tissue, so that it is easily shelled out.

Treatment.—On account of the insensitiveness of the parts involved below the skin the removal of even a large lipoma of the trunk can readily be accomplished with a local anesthetic (Figs. 104 and 105). This applies only to the simple or usual type of lipoma. For a description of the diffuse lipoma and of the intermuscular lipoma, both of which varieties are found in the trunk, see page 139. The skin is incised for a distance equal to one-half or more of the diameter of the tumor. If the tumor is covered by a layer of the subcutaneous fat, this is also divided so that the capsule of the tumor shall be exposed. This capsule is next

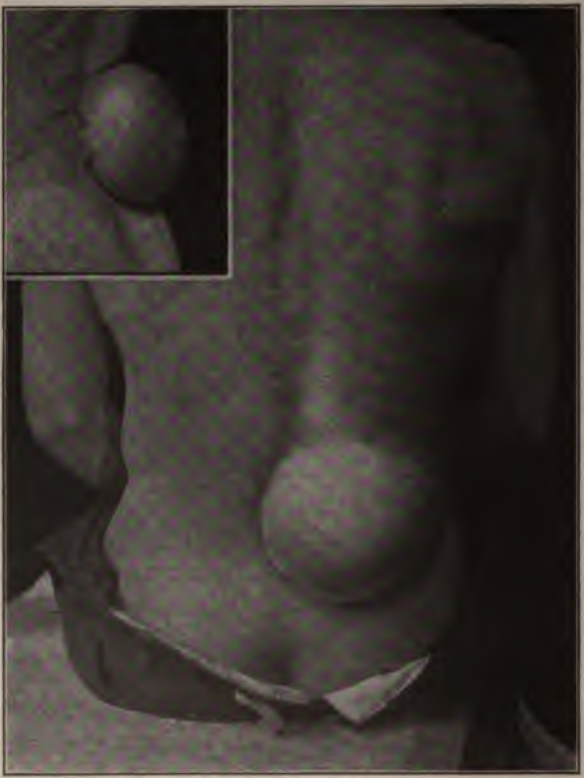


Fig. 104.—Lipoma of Back. Two years' duration; removed without pain, with an injection of 40 minims of 2 per cent. cocain solution. Another view of tumor is shown in the upper corner.

divided, and then the fatty tumor can be readily peeled out of its compartments in the fascia, by a blunt and generally bloodless dissection, with the fingers or blunt-pointed curved scissors. With the removal of the tumor the edges of the wound are to be fully retracted and any bleeding points secured and compressed or ligated with fine catgut. The skin is sutured without drainage or over a wick of gutta-percha tissue.

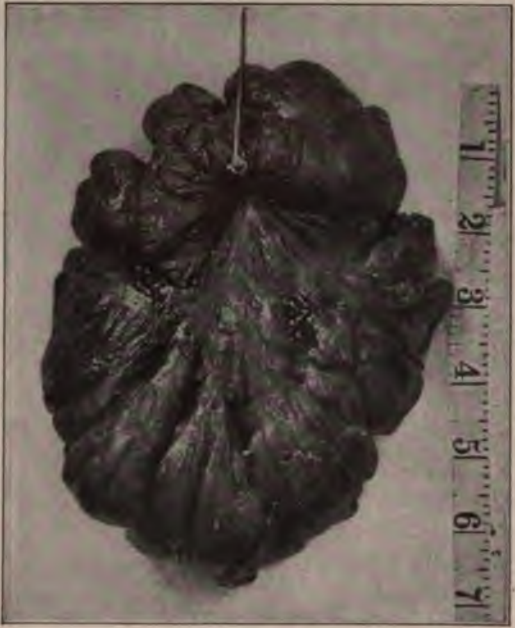


FIG. 105.—LIPOMA SHOWN IN FIGURE 104 AFTER REMOVAL. The scale of inches shows its length. Its weight was 25 ounces.

SOLID TUMORS OF THE BREAST

Hypertrophy.—Sometimes during adolescence one of the breasts will become abnormally firm and larger than its fellow and rather more sensitive to pressure, but without acute pain. The enlargement is diffuse and uniform, and there is no adhesion of the breast to the structures either beneath or superficial to it. Such a condition has a tendency to resolve in the course of time. This return to the normal state may be hastened by an application of ichthyol ointment.

Adenoma.—An adenoma or an adenofibroma of the breast is a tumor which is composed of a localized increased growth of glandular and fibrous tissue. There are several types of such tumors distinguishable microscopically, but as no adenoma is composed only of glandular tissue and no fibroma is without a certain increase in glandular tissue, and as both of these often contain cysts, an exact differential diagnosis between them is not always possible, nor has it more than a pathological significance. The tumor is generally painless and is first noticed by the patient during a bath or by accident. In other cases there is a little pain in the tumor.

TREATMENT.—Such tumors are essentially benign, but they may also change their type of growth into one which has a tendency to spread into the surrounding tissues. Hence they should be removed, or at least carefully watched from month to month in order to be sure that they are not growing. Puncture with a hypodermic needle, and aspiration, will differentiate between a cystic and a solid tumor if fluid is obtained. A negative aspiration is not conclusive (p. 183). If the tumor is small and freely movable, a local anesthetic will often suffice; but otherwise, and especially if the patient is more than thirty years of age, she should be told beforehand of the possibility of a major operation and should be given a general anesthetic. If the growth is found to be malignant, the operation should be continued until it includes the removal of the breast and dissection of the axillary and clavicular regions, and the excision of one or both pectoral muscles, according to the judgment of the surgeon. It is of great assistance at such times to have a pathologist present, who, by making frozen sections of the excised tumor, can determine whether or not it is of a malignant character. In general, one should be very suspicious of even a small, freely movable tumor which has been growing but a few months and is painful. This is especially the case if the patient is a woman more than thirty years of age.

The Early Diagnosis of Malignant Tumors of the Breast.—The treatment of malignant tumors of the breast is quite out of the range of minor surgery, but the importance of a correct diagnosis in the early stages is so great and these tumors are so often first seen in ambulatory practise, that the diagnostic points should be emphasized.

In examining a patient's breast these points should be observed:

Palpation.—The patient should lie flat on the back with both breasts exposed for the sake of comparison. Some examiners prefer to have the patient sit upright, but the recumbent position is better for a thorough examination. Each breast should then be thoroughly examined by rolling its substance between the palmar surface of the fingers and the wall of the thorax. The aim of the examination is to determine the presence of any nodules or other irregularities. If there are multiple nodules in both breasts, the case is probably one of chronic mastitis. The same is probably true of multiple nodules in one breast, for if these are cancerous, the disease will of necessity be far advanced, and some of the other symptoms will be present. A single nodule in one breast, or in each breast, may or may not be cancer. It should be further examined.

Retraction of the Skin.—This is best shown by pushing the breast, but not the tumor, toward the suspected part of the skin. Retraction of the skin, under these circumstances, is one of the most reliable signs of cancer.

A Flattening of the Normal Curve of the Breast Over the Tumor.—This is determined by sighting across it with the eye on the same level. If present it is an indication of malignancy.

The Presence of One or More Enlarged Glands in the Axilla or Between the Breast and Axilla.—This is not one of the earliest signs. Both axillæ should be palpated. If the glands in each are equally enlarged, and only one breast contains a nodule, the axillary glands are presumably non-cancerous.

Palpation of the axilla is best performed as follows: If the left axilla is to be palpated, the surgeon stands to the right side of the patient. He lifts her left arm away from the body, and places the fingers of his right hand well up in the left axilla. The arm is then lowered, or brought to the chest, until the muscles are relaxed. The surgeon is then able to draw his fingers with the skin of the axilla back and forth over the axillary contents, and to feel any glands which are present.

Retraction of the Nipple.—This is an early sign of cancer only when the disease begins under or near the nipple. In other cases the growth may be well advanced before retracting the nipple.

Hemorrhage from the nipple, either spontaneous or occurring when the nipple is gently squeezed, is a symptom of value if there is no inflammation or other obvious explanation of its occurrence.

Failure to Withdraw Fluid through a Fine Aspirating Needle.—A long hypodermic needle is sufficiently large. Fluid indicates cystadenoma in most cases, though some cancers contain fluid.

The importance of carcinoma of the breast is so great that, unless the examiner can be sure that the tumor is of a benign character, he had better assume it to be malignant. In doubtful cases a section should be removed for microscopical examination. This may be successfully done with cocain, unless the patient is of a nervous disposition. If the tumor is malignant, an extensive removal of breast and axillary gland and pectoral muscles and fascia is indicated.

Carcinoma beginning in the nipple, so-called Paget's disease, may be mistaken for eczema. There is redness and scaliness, followed by a shallow ulceration with a slightly indurated base and narrow indurated margin. It is inexcusable to neglect such a condition, since the microscopic examination of a small section of the affected skin will reveal the true nature of the disease.

Sarcoma.—Sarcoma of the breast differs somewhat from carcinoma in its gross characteristics inasmuch as it usually develops at a greater distance from the nipple and forms a diffuse swelling deeply situated beneath the skin, and often extending beyond the margin of the breast in one or more broad lobules before the surgeon's advice is sought in regard to it. It grows rapidly, without pain, and forms new nodules by continuity rather than through the lymphatic system; hence the axilla may be entirely free although the tumor has grown to a diameter of two inches or more. Such a freedom of the axilla is never seen in carcinoma of the breast of a similar size. Sarcoma grows more rapidly than carcinoma, and a thorough and early removal is, therefore, not less important.

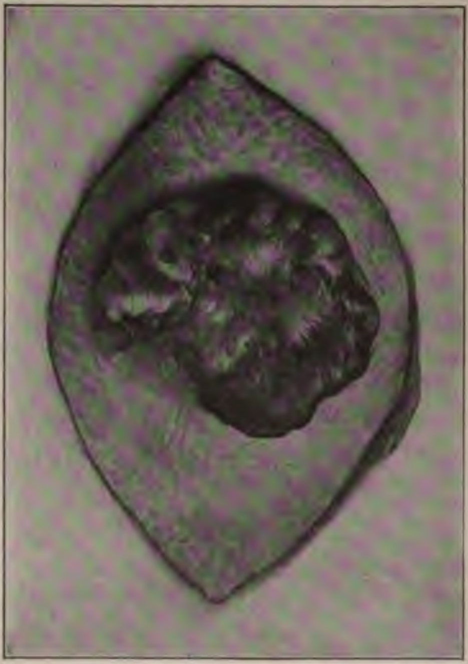


Fig. 106.—Epithelioma of the Back at an Early Stage. The drawing was made from the tumor after removal. Note the margin of healthy skin on all sides of the epithelioma.

Tuberculosis may be mistaken for a malignant tumor (see p. 180).

Tumors of the Male Breast.—The male breast, as has already been said, suffers from the same diseases as the female breast. As the fear of disfigurement is not so strong, the male patient will usually seek surgical advice soon after he has discovered the tumor of the breast. Hence the prognosis along operative lines is fairly good. If neglected, however, cancer of the male breast develops in fully as virulent a manner as that of the female breast, forming metastases, extending inward into the chest, and causing the death of the patient from exhaustion.

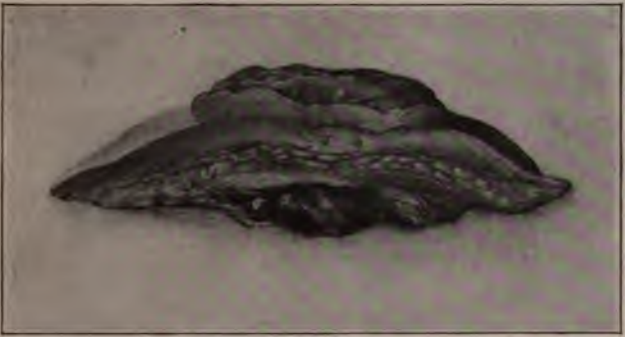


FIG. 107.—CROSS-SECTION OF THE TUMOR SHOWN IN FIGURE 106. Note that the tumor has not yet invaded the subcutaneous tissue.

MALIGNANT TUMORS OF THE TRUNK

Carcinoma and Sarcoma.—The skin of the trunk may be the seat of malignant tumors. They have no especial characteristics due to their situation (Figs. 106 and 107). If seen early, the prognosis after removal is unusually good, since the surrounding

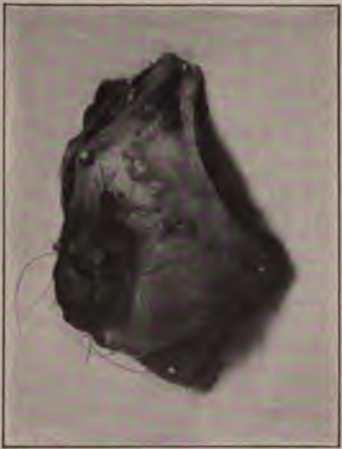


FIG. 108.—MELANOSARCOMA OF LOWER ABDOMEN OF FOUR MONTHS' DURATION GROWING FROM A MOLE OR SOFT WART. Patient a woman aged fifty-four years.

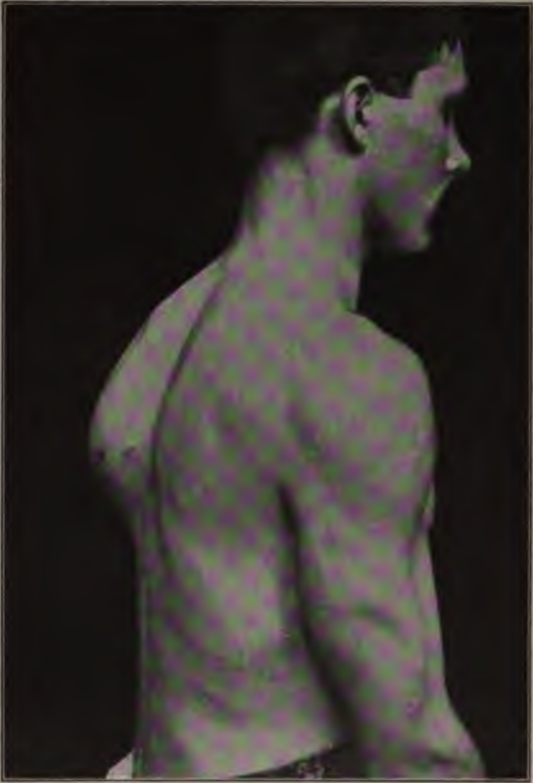


FIG. 109.—CYST UNDER SCAPULA. One week's duration. Due to subscapular osteoma and traumatism.

tissues may be sacrificed with much freedom, and hence the incision is usually carried wide of the growth (Fig. 108).

An instructive mistake in diagnosis is connected with the patient shown in Figure 109. A fluctuating swelling developed soon after an injury. Aspiration produced a bloody fluid, and the needle touched abnormal bone. A diagnosis of sarcoma of the scapula was made. When the patient was operated upon it was found that there was an osteoma of the scapula, which had so irritated an adjacent bursa as to cause an accumulation of bloody fluid.

ACQUIRED DEFORMITIES

Displaced Coccyx: Coccygodynia.—Falls upon the base of the spine may bend the coccyx backward or forward, or otherwise injure it. It may then become the seat of annoying and persistent pain, called coccygodynia. The projection forward of the bone may interfere with defecation and prevent its easy performance.

The history given by the patient of a severe fall, followed by pain and tenderness which have never entirely disappeared, should lead at once to a physical examination. The patient either stands or lies upon his side with knees drawn up. The surgeon passes the well lubricated finger high up into the rectum, the palmar surface of the finger being directed backward. The lower part of the sacrum and the coccyx can then be grasped between the forefinger and the thumb. The size and direction of the coccyx and the possible range of motion in the joint between it and the sacrum should be noted; also the existence of any tender spots.

TREATMENT.—If there is reason to attribute the existing pain to the coccyx, or if it is ankylosed or is badly deflected and cannot be brought into normal relation to the sacrum without pain, the coccyx, or a portion of it, should be removed. A two inch median incision is sufficient for the purpose. The patient's bowels should be thoroughly emptied on the previous day. At the time of operation the skin in the vicinity should be thoroughly cleansed, but no enema given nor rectal examination made just before operation. Either local or general anesthesia is satisfactory. The incision is started at the level of the joint between sacrum and coccyx and extended a distance of not more than two inches toward the anus. Skin and fat are divided and the coccyx cut down upon. The soft tissues are dissected from it

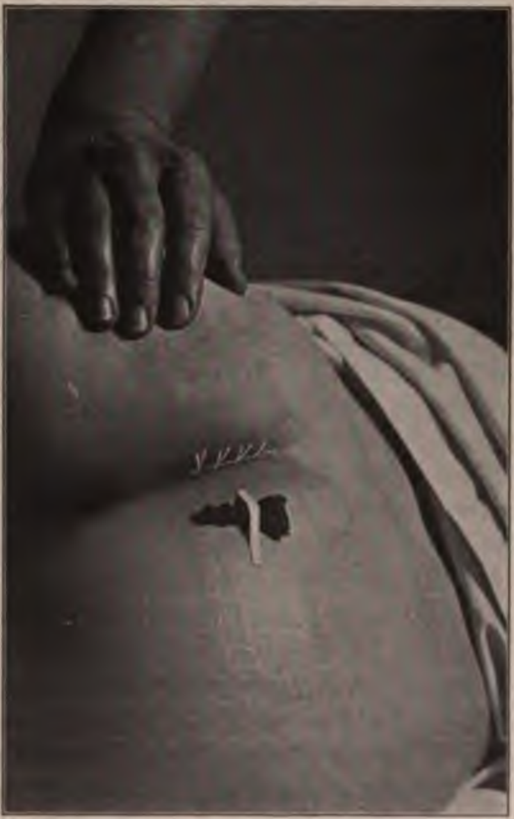


FIG. 110.—REMOVAL OF A DISPLACED COCCYX. The wound necessary for its removal has been closed by four sutures. Photograph taken four days after operation, and retouched only to make the stitches and wound more prominent. The coccyx is laid on the patient's buttock.

posteriorly and along both sides. The joint between sacrum and coccyx is opened and the ligaments divided. If the bones are ankylosed they must be separated with bone shears or a chisel. The upper end of the coccyx is then seized and pulled backward. The soft tissues in front of the coccyx are then pushed and cut away from its anterior surface and the bone is withdrawn from the wound. In this manner it is easy to avoid wounding even the outer coats of the rectum. Bleeding is controlled by pressure or ligation, the cavity is obliterated by buried sutures of catgut, and the skin is sutured with horsehair or fine black silk (Fig. 110). If any drain is employed it should be a small gutta percha one, to be removed in two days. Primary union should be obtained. The patient should lie in bed for two days, and should avoid for some days longer any sitting or other posture which will tend to separate the edges of the wound.

Hernia.—A hernial sac is a protrusion of a part of the peritoneum through an opening in the abdominal wall. In this sac there may or may not be found portions of the abdominal organs. If they can be "replaced" in the abdominal cavity the hernia is called "reducible." Otherwise it is an "irreducible" hernia. Such reduction may be impossible on account of altered shape of the organs in the sac, its "contents," so-called, or on account of adhesions which have formed around the sac and its contents. The hernia may become inflamed as a result of traumatism, etc. This rarely leads to suppuration. It may produce so much swelling of the hernial contents that the blood-vessels which supply them are occluded, and strangulation results (Strangulated Hernia, p. 198)

A hernia may exist at birth or develop soon afterward in an abnormally weak spot in the abdominal wall. It may also appear in later life, either suddenly, following some crush or severe strain or gradually, as the result of oft repeated lesser strains.

The subject of hernia, and especially its operative treatment is exhaustively discussed in works upon major surgery. Still, th general means of correct diagnosis and the ambulant treatment o patients who, for one reason or another, cannot be operated upon are here in place.

General Principles of Diagnosis.—A patient suspected t have a hernia should be examined in both standing and recumben postures.

Inspection may show variation in size at different times if the hernia is reducible. Peristaltic movements are often visible in large intestinal herniæ.

Palpation may reveal the presence of intestinal coils, of gurgling gas and fluid, of lumpy omentum, or of pasty fecal masses capable of being indented.

Compression, when the patient is recumbent, may affect the reduction of the hernia.

Percussion will bring out the resonance of intestinal coils containing gas. It will also give a thrill in case the swelling is due to a hydrocele or a cold abscess.

Auscultation may reveal an intestinal gurgle or, in rare cases, an aneurysmal thrill.

An impulse on coughing is obtained in case of most herniæ. It may also be obtained, though less marked, in case of a large varicocele or in case of a hydrocele which extends well up into the inguinal canal.

Reduction of the swelling upon compression or spontaneously when the patient lies down is very significant of hernia, but may also occur with an imperfectly descended testis or a cold abscess.

General Principles of Treatment.—Operation for hernia, wherever situated, to be successful must accomplish these three steps: 1. The reduction of the hernial contents, either before or after the sac has been opened. 2. The closure of the peritoneal cavity at the normal level. The sac is usually tied at this point, its neck, and the surplus removed. 3. The approximation by firm sutures of the damaged wall of the abdomen, or at least of its strongest part, namely, the deep fascia. The various methods of accomplishing these three steps vary in different situations and in the hands of different operators. They are fully described in all surgical text-books.

If the condition of the patient and the character of the hernia make it probable that the three steps above described can be carried out by operation, and primary union attained, operation should be advised. It is, of course, absolutely indicated in case of strangulated hernia as a relief of acute symptoms, even under circumstances in which a permanent cure of the hernia is not to be expected.

A truss is to be recommended in all other cases of reducible hernia. A patient having an irreducible, inoperable hernia is indeed in a bad state. Some of them gain relief by an operation which changes the hernia from an irreducible to a reducible one, so that a truss can be worn. An unusual type of partly reducible hernia is shown in Figure 111.

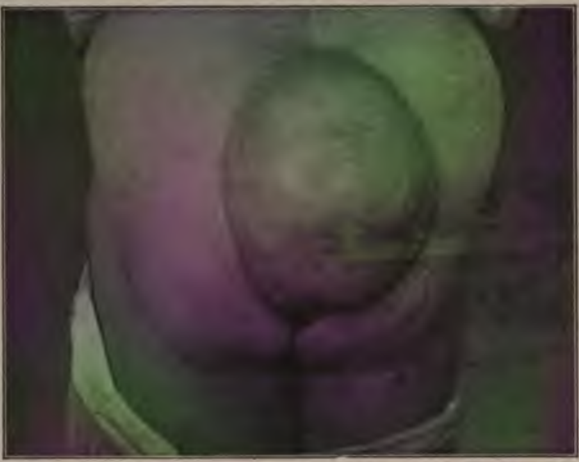


FIG. 111.—DORSAL HERNIA FOLLOWING KRASKE'S OPERATION FOR CARCINOMA OF THE RECTUM. The hernia developing through the gap in the posterior pelvic wall caused by the removal of the sacrum, contained the greater part of the small intestine and the sigmoid flexure.

The symptoms of hernia in different situations vary greatly. A brief description is therefore given of each.

Umbilical Hernia.—Hernia of the umbilicus in the new-born is extremely common. The sac is usually small and contains intestine or is empty. This hernia has a strong tendency toward recovery, but to facilitate this end it should be constantly kept pressed back by means of a cloth-covered, wooden button-mold and a short strip of adhesive plaster. This should be changed every day or every second day after the infant's bath, but before the old one is removed the new one should be prepared, and in the interval the hernia should be pressed back by the nurse's finger until the new button is put in place. The plaster should extend in a different direction every day so that the skin may not become irritated. If treated in this manner the great majority of infantile umbilical herniæ can be cured in a few months.

Umbilical hernia in the adult is especially common in stout persons of middle age. It first appears as a flabby tumor as large as the terminal joint of the finger, covered with normal skin. It is usually irreducible. Its contents are omentum. As it grows the sac becomes more distended; small intestine will often be added to the omental contents. This part of the hernia is usually reducible, at least for a considerable period. Such a hernia frequently becomes strangulated.

A truss is an unsatisfactory appliance for umbilical hernia of the adult. An operation should be performed early, if possible before intestine is involved.

Inguinal Hernia.—Inguinal hernia is more common than femoral hernia both in the male (39 to 1) and female (3 to 2); or, to put it differently, for every 84 inguinal hernias in the male there are 8 inguinal hernias in the female, 6 femoral hernias in the female, and 2 femoral hernias in the male. It is usually indirect, that is to say, the omentum, intestine, etc., which fills its sac leaves the abdomen by the normal route of the inguinal canal, and does not burst through the posterior wall of the inguinal canal to the median side of the epigastric artery (direct inguinal hernia).

Inguinal hernia may be congenital or acquired, and if acquired it may develop suddenly as the result of a crush or strain, or slowly.

SYMPTOMS.—These symptoms are usually present: normal movable skin; underlying tumor giving impulse on coughing, growing smaller or disappearing entirely under pressure or on lying down; enlarged ring and inguinal canal evident on reduction of tumor; reduced tumor does not reappear when patient stands and coughs if the canal is blocked by the surgeon's finger; no true fluctuation; opacity to transmitted light.

Possible additional symptoms of intestinal hernia are: resonance on percussion, gurgling on manipulation, indentation of doughy fecal masses in large intestine.

TREATMENT.—Treatment by operation entails only a slight risk, and is generally successful. It should therefore be advised in the case of all healthy children and active adults. Treatment by truss is advisable for feeble and aged persons and for those whose tissues in the inguinal region are so thinned by previous unsuccessful operation that they cannot be made to withstand the intra-abdominal pressure.

A truss is a pad held firmly against the lower part of the inguinal canal to prevent the exit of the omentum, etc., from the abdominal cavity. It has been well compared to the stopper of a bottle. Opinions differ as to the best form of truss. A satisfactory truss is one which, with a minimum of pressure and without causing the patient any pain, prevents the hernial contents from entering the hernial sac.

The hernia must be fully reduced before a truss is applied. This is best done when the patient lies on his back. A truss should never be applied to a hernia which is only partially reducible. It will rarely succeed in keeping back the rest of the hernial contents, and by its pressure on the part already in the sac it will cause pain and possibly serious inflammation, or even gangrene.

A truss is rarely needed in case of a very young infant; but before the child is old enough to walk it should be fitted with a truss or should be operated upon. Operation is advisable for large congenital herniæ, as cure is improbable when the neck of the sac is so wide. If the tunica vaginalis communicates with the peritoneal cavity by a rather narrow passage, and the contents of the hernial sac can be reduced into the abdomen without dragging the testicle upward, a truss may cure the patient in the course of a few years. For this purpose it should be worn constantly day and night, as crying no less than walking will force the abdominal organs into the hernial sac. As the child grows older the truss may be left off at night, and if the neck of the sac becomes obliterated the truss need only be worn during exercise, and finally not at all. A cure is sometimes obtained from a truss in adult life, but is far less likely after the patient has attained his growth.

Femoral Hernia.—In femoral hernia the protrusion of abdominal contents is under Poupart's ligament and through the femoral ring. Such a hernia is usually small, and this fact, added to the tortuous course of the canal, sometimes obscures the impulse on coughing and renders diagnosis difficult. An enlarged lymphatic gland, with which femoral hernia is often confounded, if unilateral has almost always an evident cause in some scratch or cut of the foot or leg.

Femoral hernia should always be treated by operation.

Strangulated hernia always requires treatment in bed or immediate operation, but most of the patients are seen by a physician while they are still walking about, so that the symptoms should be fixed clearly in mind, ready for instant service. They vary according to the character of the compressed organ. Omentum may become strangulated and give only moderate pain and disability for days. Large intestine, and even small intestine if only a part of the circumference of the bowel is constricted, give the same symptoms in a more marked degree, plus vomiting and more or less distention. If the lumen of the small intestine is completely obstructed there is repeated vomiting, becoming brown and foul-smelling (" fecal "), and absolute stoppage of the bowels even for gas.

The various hernial orifices should be examined in all cases of intestinal obstruction.

TREATMENT.—Dorsal decubitus, the steady pressure of a pad of unbleached cotton and a spica bandage, and the cold of a big ice-bag will cause the reduction of many strangulated hernias. This treatment should be tried only in the early hours of strangulation, lest one succeed in reducing a loop of intestine already gangrenous. In most cases immediate operation is indicated.

Ascites - Paracentesis.—The causes of simple ascites are medical, and its treatment is essentially so, except in one respect, namely, paracentesis or the puncture of the abdomen for withdrawal of the extravasated serum, for the peritoneal cavity may become so distended with serum that it is desirable to withdraw the whole or a part of the fluid. This slight operation is almost free from risk. It is best performed in the following manner: A point is selected two or three inches below the umbilicus, either in or near the median line, or well to the outer edge of the rectus muscle. Thus one chooses the thinner parts of the abdominal wall and avoids the large vessels (deep epigastric) which lie beneath the outer part of the rectus muscle. In making the puncture one naturally avoids any visible veins. The patient should, if possible, be in a sitting posture, with the bladder empty.

After cleansing the skin, the sensation may be dulled by ethyl chlorid or by the injection of a few drops of a two per cent solution of cocain. A trocar and cannula is pushed quickly through the abdominal wall. If the peritoneal cavity is so distended with fluid that the wall is tense, the puncture is an easy one; if the distention is less, one must proceed with more care. It will then be found of advantage to turn the instrument back and forth while pushing it forward, exactly as one uses an awl. In either case it is well to hold the forefinger against the side of the instrument as a guide to the depth to which it is plunged (Fig. 112).

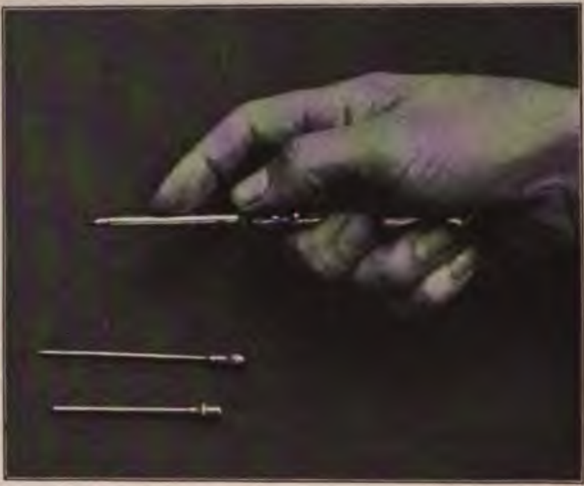


FIG. 112.—METHOD OF HOLDING TROCAR AND CANNULA BEFORE PLUNGING IT THROUGH THE ABDOMINAL WALL. The forefinger acts as a guide to control the depth of puncture. A smaller trocar and cannula are also shown.

The size of the cannula employed varies according to circumstances. If the puncture is made merely for diagnostic purposes, or if the quantity of fluid to be removed is small, one naturally selects a small cannula, possibly as small as No. 6 French. If, on the other hand, several quarts are to be removed, as is frequently the case in hepatic cirrhosis, one should select an instrument not smaller than 12 or 14 French. The elasticity of the tissues will invariably close the opening in a short time after the cannula is removed.

When the trocar is withdrawn serus fluid should flow out in a stream. If it does not, the end of the cannula has not entered the peritoneal cavity, or else it is blocked by omentum or intestine. An attempt should be made to push the cannula further inward. If this is impossible its end is not within the peritoneal cavity. In this case the trocar should be reinserted, and the combined instrument pushed further inward, or a new site for the puncture may be selected.

If fluid does not flow, although the cannula can be pushed further inward, or if a flow of fluid is suddenly stopped, it is evident that something has obstructed the inner end of the cannula. This may be overcome by tilting the cannula, or by shifting the position of the patient, or by inserting a stiff wire, first sterilized, through the cannula to keep back the obstructing mass. Cannulas have been made with lateral openings in order to prevent this annoyance, but it is rarely a troublesome one.

The risk of wounding intestine or omentum is a very slight one. Indeed, this accident can scarcely occur unless there are firm adhesions at the point of puncture. In case of repeated puncture it is therefore well to select a new site each time.

Some advise the incision of the skin with a narrow scalpel. This makes the puncture easier, but it is an unnecessary precaution unless the trocar is dull.

Whether all the fluid should be removed at one sitting will depend on the general condition of the patient. In the majority of instances there is no objection to drawing it all off.

Should the instrument puncture a vein or an artery in its passage through the abdominal wall, hemorrhage may follow the withdrawal of the cannula. It usually ceases in a minute or two, but if there is any doubt about it a little more cocain should be injected, a longitudinal incision made, the wound retracted, and the vessel ligated. This can be done without opening the peritoneal cavity.

The risk of infection following paracentesis is slight. It has doubtless been performed hundreds of times without any aseptic precaution, and yet without bad result; but this is no warrant for negligence. When the cannula has been withdrawn the opening should be sealed with a little cotton and collodion, or if the serum continues to trickle from the wound, a pad of sterile gauze should be applied and changed as often as it becomes saturated.

CONGENITAL DEFORMITY

Spina Bifida.—The only important congenital deformity of the trunk amenable to treatment is spina bifida. (For congenital cysts and sinuses, see p. 181.)

Spina bifida is a failure of development in which the bony processes of one or more vertebræ are not united posteriorly, so that there is a protrusion of the membranes of the cord making a tumor, an inch or even inches in diameter, filled with serous fluid, and whose cavity is usually continuous with that of the membranes of the cord contained in the vertebral column. The essential fibers of the cord may be pressed against the front of this sac, or may be spread out over its inner surface. As such a condition terminates fatally if left to itself, operation is indicated, and numerous successes have been reported, although it is a serious undertaking and is often followed by death.

SECTION IV

AFFECTIONS OF THE GENITO-URINARY ORGANS

CHAPTER VIII

INJURIES AND INFLAMMATIONS OF THE MALE GENITO-URINARY ORGANS

INJURIES

Contusion.—Blows upon the penis and testicles are very common. Owing to the sensitiveness of these structures they produce a degree of shock out of proportion to the local evidence of injury. The freedom of motion of these parts often saves them from severe injury. Swelling, especially of the testicle, may be considerable even after a slight injury. Deep injury may result in extensive extravasation of blood, with or without rupture of the erectile bodies or of the urethra, or it may be accompanied by hemorrhage into the tunica vaginalis, known as hematocele; while a still deeper injury may cause rupture of the bladder, intraperitoneally or extraperitoneally.

Diagnosis.—The diagnosis of the lighter forms of injury is usually not difficult. An inspection of the parts supplemented by palpation will usually reveal the extent of the trauma. Owing to the laxity of the tissues extravasated blood spreads rapidly, while edema finds little restraint and may quickly alter the normal appearance of the penis. The diagnosis of the deeper injuries is considered under the separate titles.

Treatment.—This consists in rest, support of the parts, and cooling applications. Compresses wet with a mixture of alcohol and water or fluid extract of hamemelis, should be applied and kept moist. No impervious substance should be used to cover them, as the cooling effect of free evaporation adds greatly to the comfort of the patient in most cases. Or the wet compresses may be covered with flannel, oil silk, or gutta percha tissue, and the dressing kept cold by an ice-bag placed alongside of it. While the patient is in bed the testicles should be supported on a folded towel placed across the thighs. As soon as he is up the weight of a swollen testicle should be taken off of the cord by a suspensory bandage. If there is subcutaneous hemorrhage which is not controlled by these measures, or if an erectile body has been ruptured, an incision should be made and the bleeding vessel secured or the fibrous envelope sutured.

Contusion of the testicle is apt to be followed by pain, more noticeable toward night or after exertion. An ointment containing belladonna or ichthyol should be applied and the testicles supported by a suspensory bandage.

Hematoma: Hematocele.—The blood from a ruptured vessel usually spreads quickly throughout the loose subcutaneous tissue. In this manner penis and scrotum may in a short time become a dark garnet or magenta in color. In other cases the blood may accumulate in one place and so form a hematoma. This is most likely to occur if the ruptured vessel empties into the tunica vaginalis. Such a condition is called a hematocele. It may exist without any discoloration of the skin. It gives rise to a smooth, tense fluctuating swelling, the size and shape of the distended tunica vaginalis. Often the swollen testicle is lost in the mass of clotted blood so that it cannot be distinguished. A hematocele can be differentiated from a hydrocele by its rapid formation, by its opacity to transmitted light; from a hernia by its irreducibility, by the absence of an impulse on coughing, and by the fact that the swelling does not extend into the inguinal canal.

Treatment.—Extensive hemorrhage in the tissues, if diffuse, will take care of itself. If, on the other hand, there is a large hematoma, an incision should be made into it and the blood clot taken out and the wound closed. The best time for the removal of the effused blood by aspiration is a few days after the accident, when the cutaneous effects of contusion will have subsided and the blood clot will have softened somewhat. If operation is not performed the blood clot will remain for months before it is entirely absorbed, even if it does not act as a foreign body and cause necrosis of the overlying skin. Such an operation is free from risk if asepsis is rigidly observed. The wound may be sealed with a cotton-collodion dressing.

"Fracture" of the Penis.—A too violent effort in coitus, as well as some form of direct violence, may rupture one of the erectile bodies of the engorged penis. The result is the immediate escape of blood from the fibrous sheath in which the erector vessels are confined, producing a flabby and distorted penis. If there is also a wound in the skin the blood may escape externally.

TREATMENT.—The non-operative treatment consists in the application of cold and a firm bandage. The results are often unsatisfactory, as is to be expected, when one considers the amount of the effused blood and the structure of the penis itself—so ill adapted to a firm bandage. The blood clots are not fully absorbed for a long time, scar tissue forms, and the deformity is often permanent.

The modern surgical treatment in these cases is an immediate exposure of the ruptured tissues by a longitudinal incision, control of the hemorrhage by ligature or otherwise, suture of the fibrous sheath with fine chromic catgut, and suture of the skin-wound with horsehair or fine silk. With reasonable care, wounds in the penis heal ascptically. The operation may be performed with a local or general anesthetic. The blood supply in the organ may be controlled during the operation by an elastic rubber band wound around the root of the penis. This will also facilitate local anesthesia by limiting the diffusion of the solution employed. The rubber bandage should be removed before the skin is sutured in order to test the control of deep hemorrhage.

Paraphimosis.—If a too tight foreskin is fully retracted over the corona of the glans, the head of the penis swells so that it is difficult to draw the foreskin down over it. The longer the condition lasts the more difficult it is to relieve it. Soon the foreskin becomes edematous, and this adds to the difficulty of reduction. The ability to urinate is usually not impaired.

TREATMENT.—To reduce a retracted foreskin it should be grasped with the thumb and finger of either hand at opposite points of its circumference, the thumbs being nearer the glans penis and firmly fixed upon the foreskin as close to the corona as possible. If the skin is slippery it should first be wiped dry and clean. Most of the obstruction to reduction is on the dorsal side of the penis, and hence the points at which the foreskin is seized should be situated a little more dorsally than ventrally. Steady tension should now be exerted, the two hands pulling in slightly divergent lines in order to assist in relieving the constriction of the foreskin over the corona.

If the efforts at reduction are unsuccessful the surgeon may bandage the penis with a thin rubber bandage, and so reduce swelling, or he may use a gauze bandage and saturate it with an astringent solution and leave it in place a few hours. This treatment may so reduce the swelling that the foreskin can be drawn over the glans. If the condition of the parts, such as marked congestion or threatened gangrene, forbids delay, the foreskin should be divided dorsally by an incision parallel to the long axis of the penis (see p. 246). Reduction will then be easy. The operation should be completed by suture, but the longitudinal incision should be sutured laterally, or a partial or complete circumcision may be at once performed. If a tight paraphimosis is left to itself a spontaneous reduction may take place or the retracted skin may become adherent in its new relations so that reduction is impossible; or it may lead to gangrene of either the constricting skin or of the head of the penis.

Neuralgia of Testicle.—Violent coitus may produce neuralgia of the testicle, and even a swelling of the organ, which the patient calls a "strain." It is best treated by a suspensory bandage, by the application of cooling lotions, or of belladonna or ichthyol ointment, and by the avoidance of sexual excitement until the symptoms have disappeared. If the patient is troubled with erections during sleep, large doses of bromid of potash should be given during the afternoon and evening, and the bowels should be thoroughly emptied. In many cases of neuralgia of the testicle of sexual origin, relief follows the occasional passage of a steel sound through the deep urethra.

Whenever possible, these patients should be encouraged to take up normal sexual life, for frequently and unjustly they mistrust their power to enter into a happy marriage. Experience has repeatedly shown that all the neuralgic symptoms disappear in a few weeks after marriage.

Foreign Bodies of the Penis and Urethra.—A special form of injury of the penis is caused by slipping a ring over the end of the organ. The congestion which results swells the glans so that it is impossible to remove the ring. This congestion increases as time goes by and if surgical aid is not sought gangrene will follow. But before this occurs the ring may be so buried in the edematous skin as to be invisible unless a careful examination is made.

Foreign bodies are also passed up into the urethra for purposes of sexual excitement. They sometimes slip from the grasp of the individual and pass wholly within the meatus.

The symptoms vary according to the nature of the foreign body lodged in the urethra. If this is smooth there may be no serious symptoms until a calculus forms about it some weeks later, or infection of the urethra or bladder may be caused. This is more likely to follow the introduction of a sharp object such as a pin. If the urethra is torn, the swelling may make urination difficult or impossible.

TREATMENT.—A ring which has been passed over the penis should be filed or cut in two places and removed. Usually a thin strip of steel can be passed under the ring at some point in its circumference in order to protect the penis from the file.

The extraction of a foreign body from the urethra is often extremely difficult. If the body lies near the meatus it may be seized and drawn outward by a pair of thin forceps. Before attempting the seizure, firm pressure should be made upon the urethra near the base of the penis so as to prevent the foreign body from slipping upward into the bladder. If the object is sharp-pointed, as a pin, and the point is toward the meatus, it may be pushed out through the wall of the urethra and the penis, reversed, and pushed back into the urethra, so that the head is toward the meatus. The head can then be grasped with forceps and the pin extracted. If the foreign body is not sharp-pointed, as, for instance, a slate pencil, it may be extracted by pinching the urethra firmly above its upper end and crowding the penis upward past its lower end. The lower end is then grasped through the penis, and traction is made in order to stretch the urethra to its fullest extent. While thus stretched the urethra is again pinched above the upper end of the slate pencil, and the penis again crowded up from below. By this means the foreign body can be brought out of the meatus. This method can be easily demonstrated by slipping a slate pencil into a piece of rubber tubing whose caliber is great enough to receive it readily.

If the foreign body cannot be extracted through the meatus, an incision should be made directly down upon it to permit of its prompt removal. The wound of the urethra should be sutured at once, and also the wound of the skin unless infection exists, in which case drainage may be advisable.

Foreign Bodies in Bladder.—A foreign body which finds its way into the male bladder, either through the urethra or by penetration of the wall of the bladder, usually becomes incrusted with urinary salts in a short time.

The symptoms depend more or less on the nature of the object, whether it has sharp angles, etc. They are in general pain, especially at the end of micturition; vesical irritability, as shown by pain when the body is jarred and by frequent micturition; and an admixture of blood with the urine, and perhaps the passage of a couple of drops of pure blood at the end of the act. The foreign body may cause a sudden stoppage of the urinary stream during micturition. If a foreign body remains in the bladder for some time, the urine may become ammoniacal. The symptoms given are also the symptoms of calculus.

The diagnosis can be made from the symptoms; also by means of a short, sharply curved steel sound called a stone searcher; in some instances by the X-ray, and in some by the cystoscope.

TREATMENT.—The removal of the foreign body is the essentia of treatment. This usually requires an incision into the bladder The suprapubic route is the method of choice.

Wounds.—All wounds of the external genitals should b treated by thorough cleansing, control of hemorrhage by ligature suture of both superficial and deep structures, and if necessar drainage. The tendency of contused wounds to bleed subcutaneously is very marked, on account of the free blood-supply an lax tissues. All blood clots should be evacuated, and the spaces i which they lie should be suitably drained.

Rupture of Urethra.—This may be complete or partial. I is usually due to a fall astraddle of some hard object or to a kic in the perineum. By this violence the bulbous urethra is presse against the edge of the pubis and divided.

The symptoms are pain and swelling at the seat of injury, an usually bleeding from the meatus. There will be either inabilit to pass water or painful, dribbling micturition, the urine contai ing blood, or, as is usually the case, the passage of a little urine from the meatus and the extravasation of a certain amount of urine about the point of rupture. If there is an external wound the urine will escape from it. If not, the passage of an olive-tipped bougie will usually establish the diagnosis. If the urethra is torn clear across the bougie will fail to enter the vesical portion, or if it is only partially torn the rent in the membrane may be felt. Sometimes the break may be felt by external palpation. A doubtful diagnosis will usually exist only in those instances in which the urethra is divided without the skin being broken.

Treatment.—The treatment for all cases of partial or complete rupture of the urethra is immediate incision and suture. Only the simplest cases of rupture of the pendulous portion may be left to heal of themselves. If the divided ends are retracted, or if a portion of the urethra is so badly bruised that it has to be cut away, suture of the urethra is still possible by loosening it from its attachments a little distance in both directions. An inch of the urethra has been resected and the urethra sutured with complete success. For this purpose fine silk should be used, and only two or three of the sutures should pass clear through the mucous membrane. Unless the wound determines the site of the skin incision, it should be a longitudinal one made in the median line of the under surface of the penis. After operation has been completed, a catheter should be left in the bladder for several days. This operation may be easily performed with the aid of a local anesthetic. The stitches should be removed in five days or a week and the catheter two or three days later. In most instances the deeper parts will heal with scarcely any leakage of urine. Should this occur the sinus will in a few days close of itself, since, unlike the condition when an inflammatory stricture is present, the tendency after traumatism is toward recovery. All silk sutures should be so placed that they can be removed, and for this purpose their ends should be left long; otherwise plain catgut should be employed. If, in spite of all precautions, suppuration occurs, the catheter must be taken out of the bladder and the wound freely drained. After the inflammation has subsided, a second operation may be undertaken to close a persisting sinus. If the sinus is a large one or traumatic stricture exists, a section of the urethra must be cut away so that clean fresh ends may be obtained for suture.

Rupture of the Bladder.—The rupture may be extraperitoneal, but is usually intraperitoneal. In either case the accident is a serious one and follows a blow or fall, usually when the bladder is full. When it is overdistended a comparatively slight blow may rupture it.

SYMPTOMS.—Rupture of the bladder has some symptoms in common with rupture of the urethra; but it may be differentiated by the history of the accident, by pelvic pain and shock, by the absence of visual injury in the perineum or along the penis, by the fact that blood in the urine is thoroughly mixed with it and does not appear simply at the beginning or the end of the urinary act, and possibly by the complete absence of urine, even after the passage of a catheter. Unless stricture is present there will be no difficulty in passing a catheter into a ruptured bladder. Extravasation of urine into the deeper parts of the pelvis, or its discharge into the peritoneal cavity, will also cause symptoms which will assist in the diagnosis of the injury.

TREATMENT.—An immediate suprapubic cystotomy is the best form of treatment. In many cases this must be combined with a laparotomy.

Rupture of the bladder should be considered a possible complication in all cases of fracture of the pelvis.

INFLAMMATIONS

Burns.—Burns of the external genitals may be of the usual kind, or they may be due to the application of too strong ointments or lotions. The symptoms and treatment are those of burns elsewhere in the body (see p. 26). On account of the great looseness of the skin and the relative firmness of the deep fascia of these parts, the edema resulting from even a slight burn may produce great distortion (Fig. 113). Such an edema is, of course wholly temporary, and the patient should be so assured.

Simple Balanitis.—This is an inflammation of the mucous membrane covering the head of the penis, and the inner layer of the prepuce. It is common in cases of long prepuce, especially if the foreskin cannot be retracted. Under such circumstances the secretions about the corona remain in a moist condition and undergo fermentations. Erosion of the delicate epithelial layers results, with foul smelling discharge. Diabetics are especially subject to irritations of the foreskin.

Treatment.—Cleanliness, the application of a powder, such as stearate of zinc, or the application of a bland ointment such as cold cream, will heal the simplest cases. The apposed surfaces may be kept apart by a wisp of cotton moistened with a dilute antiseptic. If the foreskin cannot be retracted, or if it is very long, so that the head of the (adult) penis is completely covered, circumcision should be performed. The resulting exposure of the corona will stimulate the growth of a tougher epithelium, and will dry the secretions more rapidly. In operating upon diabetics, one should remember the possibility of a failure to obtain primary union.

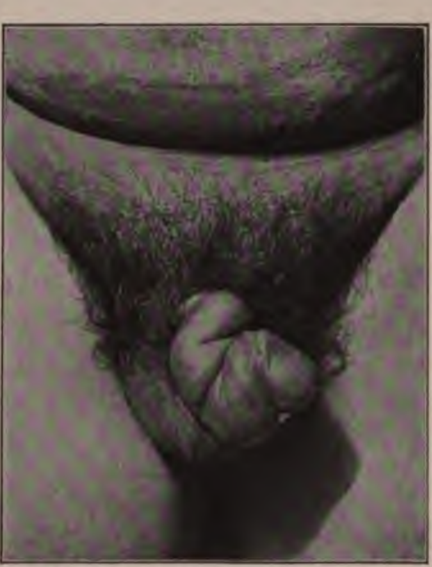


Fig. 113.—Edema of the Penis and Scrotum in Burn due to the Application of Mercuric Ointment.

Herpes of the Penis.—The glans penis and the inner layer of the prepuce may break out with the characteristic groups of vesicles by which herpes is known in all portions of the body. In the case of the penis, however, the apposition of the two epithelial layers leads to the speedy maceration of the vesicles, so that if the patient is not promptly seen, only shallow ulcers may be found, together with more or less general inflammation.

The treatment is similar to that advocated for balanitis. The apposed surfaces should be kept apart by a wisp of cotton or a layer of gauze moistened with some mild antiseptic, such as a dilute silver solution, or a drying powder may be employed, or a simple ointment. The parts should be frequently cleansed with hot saline solution to prevent irritation from accumulated secretion. If the digestion of the patient is faulty, it should be corrected.

Simple Urethritis.—Inflammation of the mucous membrane of the urethra, not due to the gonococcus, may follow traumatism, such as the use of sounds, or excessive or unclean coitus, or the ingestion of drugs which, passing out through the kidneys, may irritate the urethra, etc. The symptoms are those of catarrh of mucous membrane everywhere—namely, swelling, tenderness, redness, and an increase in the mucous secretion, which in some cases may be purulent. Micro-organisms may be found in the discharge, but they will not be gonococci. The lack of exposure to gonococcus infection, the absence of gonococci from the discharge, and the quick disappearance of symptoms, serve to differentiate simple urethritis from gonorrhea.

Treatment.—With the removal of the cause of irritation and dilution of the urine, the inflammation quickly subsides; usually in less than a week. The patient should drink as many as four large glasses of water, preferably hot, and taken an hour before meals and at bedtime. Sweet spirits of niter, or acetate of potash, or some other diuretic should be given to reduce the acidity of the urine.

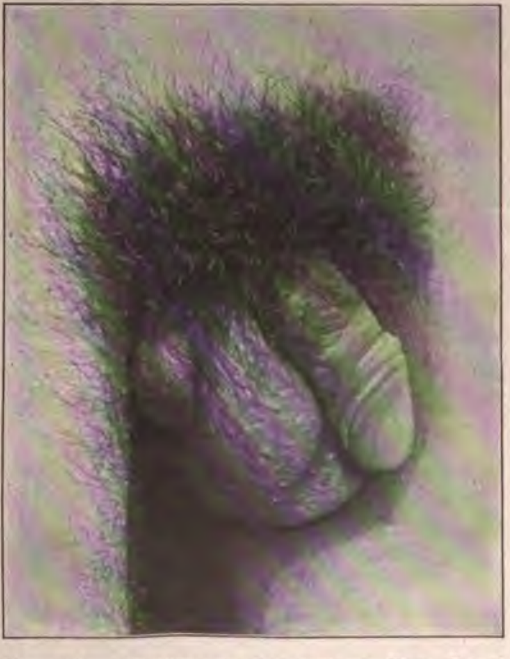


Fig. 114.—Abscess of Scrotum of Five Days' Duration. Patient aged twenty-five.

Abscess.—Most of the infections of the external genitals are of a venereal character, due to the organisms of gonorrhea, chancroid, or syphilis. Cellulitis and abscess due to the usual pyogenic organisms do occur, however, both in the penis and in the scrotum. A case of the latter character is shown in Figure 114. The symptoms and treatment are similar to those of abscess in other parts of the body.

Specific Urethritis, or Gonorrhea.—Gonorrhea as commonly seen is an acute inflammation of the anterior urethra due to the presence of a specific microbe called the gonococcus. According to the best authorities it can be obtained only by contact with a person who has recently suffered from it, or with some of the discharges from such a person. In most cases it requires from two to four days for the germ to develop in the epithelium after its introduction into the urethra. After this interval free from symptoms, there is noticed an itching or burning, or pain greatly increased during micturition and during an erection, and a purulent discharge. The mucous membrane swells, and often pouts from the meatus. The inguinal glands swell and become tender, but rarely suppurate. These symptoms continue for two or three weeks and slowly subside.

TREATMENT.—The varieties of treatment advocated for this very common trouble are numerous indeed. None of them is able to cut short to any great extent the average duration of the disease. The discharge continues usually about six weeks. It is noticeable, however, that in succeeding attacks the disease pursues a briefer and milder course. As is the case in most acute inflammations, very hot water is grateful to the patient, who should soak his penis once or twice a day in a large tumbler filled with water as hot as he is able to bear it, with the idea of relieving the mucous membrane from the irritation of its own discharges, as well as in the hope of sterilizing the urethra and thus cutting short the attack. Many specialists upon genito-urinary diseases have advocated the use of irrigation. For this purpose a blunt pointed nozzle is provided which contains two openings side by side. With each of these a tube is connected, one coming from the reservoir of irrigating fluid, the other leading to a waste pail. The nozzle should distend the meatus so as to prevent the escape of fluid around it. Irrigation may be carried out by allowing the stream to flow continuously or by occasionally stopping the outflow in order slightly to distend the penis before the fluid flows out of it. Mild antiseptic solutions can be used for this purpose; permanganate of potash in water, 1 part to 2,000, is one of the favorites.

It has been claimed that injections and irrigations have a tendency to spread the gonorrhea to the prostate, bladder, or testicles, but without injections of any sort being made these secondary inflammations often develop, so that an injection in which no undue pressure is employed probably does not spread the disease to deeper parts. Nature has provided an irrigation for the urethra in the flow of urine through it at frequent intervals, so that the irrigations above described are not as necessary as they otherwise would be.

The urine should be kept bland by causing the patient to drink large quantities of water, milk, weak tea, lemonade, etc. If it is desirable to reduce acidity still further, acetate of potash, ten grains every four hours, or some other diuretic may be given.

Rest is another essential of treatment. The patient should lie down as much as possible, and should avoid exercise, tobacco, alcohol, and sexual excitement of any kind. If troubled during sleep with erections of the penis, the patient should take during the afternoon and evening thirty or forty grains of potassium bromid. Constipation should be prevented, and the diet should be a simple one. Such are the general principles of the treatment of acute gonorrhea upon which all writers agree.

The specific treatment, that is, treatment which has in view the cure of the disease by the use of drugs, is by some writers asserted to be useless; most specialists, however, administer drugs by the mouth or in injections into the urethra, or by both of these methods. The drugs given internally are chiefly copaiba, cubebs, sandalwood oil, and salol. These are all substances which are rapidly excreted by the kidneys, and give to the urine an aromatic odor and a certain degree of disinfecting power. A good prescription is as follows:

℞ Salol, Oleoresin cubeb,	āā	gr. iv;
Balsam copaibæ		gr. viij;
Pepsin		gr. j.

One or two capsules, each containing the above, should be given after each meal.

The other method of administering drugs—namely, that of injecting solutions into the urethra—opens a wide field for experimentation. Astringents of every sort, and most of the old and new disinfectants, have been repeatedly used for this purpose. Their efficacy in limiting an acute gonorrhea is open to grave doubt, though the astringent solutions are of undoubted benefit in the later stages of the disease when the purulent secretion has changed to a thin mucous secretion. The following solution is often employed:

℞ Argyrol	ʒiv;
Aquæ destil.	℥viij.

Sig.: Use locally after urination.

Or at a later stage, when the discharge becomes muco-purulent, the following mixture:

℞ Zinc. sulphat.	gr. xv;
Plumbi acetatis	gr. xx;
Tinct. opii, Tinct. catechu, āā	ʒij;
Aquæ ad	℥vj.

M. Sig.: To be injected after urination.

COMPLICATIONS.—The prostate, bladder, and testicle may all take part in the gonorrheal inflammation. It requires usually two or three weeks for the disease to spread to these localities, but when it has done so the same symptoms of heavy pain, heat, swelling, and tenderness to touch are present in these different localities, and the patient has the constitutional symptom of fever of 100°–102° F. If the bladder is affected, micturition is frequent and urgent, extremely painful, and is often followed by the passage of small quantities of blood. Blood may also be mixed with the urine. Inflammation is situated in the neck of the bladder as well as in the prostate, and most of the pain is referred to the base of the penis and to the perineum. Large doses of alkaline diluents, local application of heat in the form of hot compresses, or a hot sitz-bath and irrigation of the rectum with hot water, or heat applied through a closed rectal tube, will all relieve the patient somewhat, but for a few days morphin will probably be required, and may be administered by the mouth or subcutaneously or by rectal suppositories. If the inflammation does not subside in a few days the bladder should be irrigated daily through a soft rubber catheter with hot saturated solution of boric acid, or with very weak solutions of nitrate of silver (1: 4,000) at the beginning, or a solution of protargol (1: 2,000).

If the disease extends to the testicles it usually attacks only one of them at a time, and involves chiefly the epididymis. This swells rapidly until it is several times the normal size, and is exquisitely painful and tender. Rest in bed, support of the testicle by folded towels placed upon the thighs, and the application of pounded ice or hot, moist compresses kept hot by a hot water bottle, will suffice to relieve the pain in a few days. Painting the overlying skin with a mixture of equal parts of guaiacol and olive oil will also relieve pain. Often the swelling persists for weeks, and the testicle should be carried in a suspensory bandage for a long time after the patient is up. Its return to the normal size can be hastened by the application of a mixture of mercurial and belladonna ointment.

Chronic Gonorrhea: Posterior Urethritis.—By the treatment described, or even without treatment, the discharge in acute gonorrhea usually ceases in about six weeks. Occasionally, however, some few symptoms of the disease remain—a little pain after urination, an occasional drop of clear mucus sufficient to keep the meatus moist and to disturb the mind of the patient, or a few shreds in the urine. The disease has passed into a chronic state and is known as chronic urethritis or gleet. In such a form it resists treatment most persistently. This is due sometimes to irregularities in the urethral canal, either natural or the result of the inflammation. Behind a small meatus there may be a little pouch in which the inflammation continues, and lights up from time to time after any slight irritation. Or there may be a stricture at any point in the urethra behind which the inflammation keeps up. Such a stricture is due to the contraction of scar tissue, which occurs everywhere in the body where healing has followed severe inflammation or loss of tissue. The persistence of the inflammation may also be due to the fact that the gonococci have lodged in the prostatic ducts. In these narrow passages they are with difficulty reached by injections, and are not affected by the flow of urine.

TREATMENT.—A narrow meatus or a stricture should be divided. If posterior urethritis exists the most successful treatment is the injection of a few drops of a strong solution of nitrate of silver by means of a deep urethral syringe. The solution first injected may have a strength of one per cent; later, if necessary, stronger solutions may be employed. The instrument should be passed into the membranous urethra, i. e., about six inches from the meatus, before the fluid is injected. The injections should be repeated every two or three days. The effect of the treatment is heightened if the prostatic ducts be emptied once or twice a week by digital pressure applied to the prostate gland through the rectum.

Stricture of Urethra.—This is a cicatricial narrowing of the canal, usually due to scar formation after gonorrhea. If the caliber is only slightly reduced, the symptoms are not severe. There is slight discomfort on urination, and the stream is irregular or interrupted. There may be a discharge of a few drops of clear mucus at times. If the stricture is very tight, the patient is constantly exposed to a complete obstruction (see Retention, p. 219).

TREATMENT.—The aim of treatment is to make and keep the caliber of the urethra sufficiently large, and also uniform, so that pouches may be done away with. A narrow meatus should be divided downward by a blunt pointed knife, after a little cocain has been injected hypodermically. When this has been done the urethra should be carefully examined with olive tipped bougies or with a urethrometer. These instruments should be sterilized and lubricated with a sterile medium such as boiled olive oil, or one of the manufactured preparations containing sea-moss. These are soluble in water, and in their other physical properties closely resemble mucus. The meatus having been cleansed, the head of the penis is grasped lightly, and a small bougie is passed slowly inward until its point meets an obstruction or reaches the membranous portion of the urethra. If no obstruction is found, larger and larger sizes are employed until the limit of that particular urethra has been reached.

If a stricture is present it may be dilated gradually or immediately, or it may be divided with special cutting instruments. All of these forms of treatment have often been carried out in the surgeon's office or in the dispensary, but sudden dilatation or divulsion, as it is called, is uncertain and is not now in vogue. Division of the stricture with a cutting instrument (internal urethrotomy) is not without danger. There is some risk of hemorrhage, but this is usually controlled without difficulty. A greater risk is due to the severe nervous symptoms which sometimes follow even a slight insult to the urethra.

The choice between gradual dilatation and division of a stricture depends somewhat upon the condition of the patient and his circumstances, as well as upon the character of the stricture. If the latter is elastic, of not too small caliber, and gives only moderate symptoms, most surgeons are content with gradual dilatation. This should be carried on under strict aseptic precautions, steel sounds (Fig. 115) being passed every two or three days if the urethra does not react too violently. Later when a full sized sound is easily passed, the treatment may be performed only once in a week or two. The sound should be held as lightly as a pencil between the tips of the thumb and fingers.

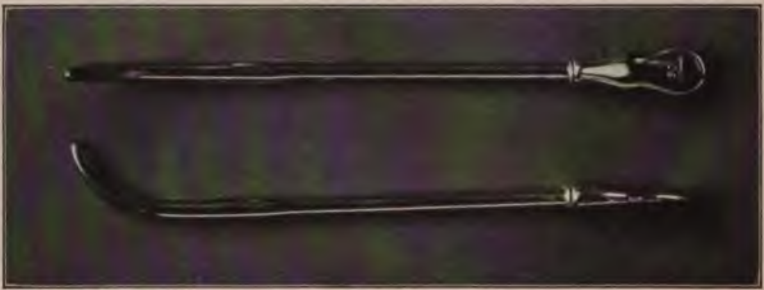


FIG. 115.—A GOOD TYPE OF STEEL SOUND. The shaft is smaller than the shoulder and does not therefore drag the meatus. It should be held as lightly as a pencil.

If the passage of the sound is too painful, a few drops of a one per cent solution of cocain may be injected into the urethra. A strong solution of cocain should never be used for this purpose, as death from absorption has more than once occurred. On each occasion two or three sounds, each one a little larger than the preceding one, may be passed; but it is well to begin each time with a sound one or two numbers smaller (French scale) than the largest one passed at the previous treatment. This gives the patient confidence at the start, and reminds the surgeon of the particular curves of the patient's urethra. The permanent cure of a stricture is often a matter of several months.

Internal urethrotomy is not properly a minor surgical operation, and need not be considered in detail. Suffice it to say that after the stricture is cut the caliber of the urethra should be at once tested by the passage of a full sized sound. This should be repeated again in four or five days, and every few days thereafter for a month or so.

Retention of Urine.—If a stricture of the urethra is very tight, admitting only the smallest instruments (No. 6 French or less), the symptoms mentioned above are more pronounced and at any time an acute swelling of the mucous membrane about the stricture may shut off the passage entirely. When this occurs, there is a complete retention of urine, one of the most painful conditions which can possibly be experienced. Sometimes the straining bladder may force a little urine past the stricture, but without much relief of the symptoms of retention. There will then be a constant dribbling sufficient to keep the patient alive, but not to relieve him of his agony. This condition of affairs requires immediate treatment.

Although stricture is the commonest cause of retention of urine, it is well to bear in mind that it may be due to a number of other causes, such as enlargement of the prostate gland, a condition not usually found before middle life; or a stone in the bladder; or injury to the deep urethra or the bladder; or a tumor; or it may follow exposure to cold in persons of delicate constitution; or accompany lesions of the spinal cord. The history of the patient, together with the facts elicited by examination, should enable the surgeon to make a correct diagnosis in most cases. The necessity for immediate relief is equally great, whatever the cause of the retention.

TREATMENT.—The simplest measures should first be tried. Sometimes, to the great relief of patient and surgeon, a medium sized soft rubber catheter, if well lubricated and steadily pressed against the obstruction, will after a few minutes pass the stricture and bring the desired relief. When the bladder has been emptied, or partially emptied if its distention has been very great, and the patient has been put to bed on a light diet and his bowels moved, the power to empty the bladder voluntarily often returns; but should subsequent catheterization be necessary, it is usually easily performed. When acute symptoms have passed over, the stricture should be appropriately treated.

If a soft catheter cannot be passed, success may follow the use of a silver instrument, although more often the point is pushed through the mucous membrane and burrows outside of the urethra without reaching the bladder.

The bladder itself may be aspirated by means of a fine trocar and cannula inserted just above the pubes. As the greatly distended bladder has lifted the peritoneal reduplication, there is no danger that the instrument will enter the peritoneal cavity. When the bladder has been thoroughly emptied, catheterization or normal urination may become possible.

In more severe cases of retention three methods of radical relief are available: namely, suprapubic cystotomy, internal urethrotomy, and external urethrotomy. The objection to the first, if the retention is due to stricture, is that it does not relieve the cause of the retention. The second is only possible in case a filiform bougie can be passed into the bladder. If this can be done, usually enough urine will escape around it to relieve very materially the patient's condition, and after a few hours the stricture will dilate sufficiently to allow the passage alongside of the filiform of the guide to Maisonneuve's instrument for internal urethrotomy, or with the filiform alone in position an external urethrotomy may be performed. This is a comparatively easy operation under the circumstances. If, however, no guide can be passed into the bladder, the external urethrotomy may be extremely difficult, since the finding of the urethra beyond the stricture may tax the surgeon's ability to the utmost. The details of these operations are found in all good surgical text-books.

Incontinence of Urine.—Dribbling of urine from an overfull bladder is really a symptom of retention, although it is generally spoken of as incontinence. True incontinence, or the inability of the bladder to retain the usual amount of urine, may be due to disease of the bladder itself or to some alteration in its nervous control. An example of the latter is the incontinence of childhood.

Incontinence of Childhood.—This is seen in both sexes, and may be diurnal or nocturnal, though the latter is more common. It is a continuation of an infantile condition, but parents do not usually pay much attention to it until the child is five or six years old. It varies greatly in degree, some children wetting the bed every night or twice a night, others being affected occasionally. The children who are affected in the daytime are seized with a desire to urinate and cannot retain the urine long enough to get to a closet.

Treatment.—The urine should be examined, the daily quantity determined, and the maximum capacity of the bladder ascertained. Acid urine should be rendered bland. The possibility of vesical calculus should not be overlooked.

The general health and habits should be attended to. One little girl showed marked improvement as soon as she gave up jumping rope.

The intelligent cooperation of the child should be obtained. Usually the child has been scolded and punished until it is filled with fright and shame at the mere thought of urination. This is, of course, an unfavorable attitude of mind and should be changed as quickly as possible. To give the child a correct view of the functions of its bladder and of the possibility of strengthening them by exercise and by voluntary retention of urine after the desire is first noticed, will at once gain its sympathy and assistance. The amount of urine passed at one time and the length of intervals between urination should be graphically shown by a measuring glass and a record.

The patient should not drink freely in the evening and should retire with an empty rectum as well as bladder. The clothing should be light. Constipation should be relieved. A long foreskin should be removed by circumcision. In every case, male or female, a careful physical examination should be made. Sometimes seat worms are an exciting cause.

Belladonna, quinin, and some other drugs may be tried. Many cures have been reported following their use.

In obstinate cases a small steel urethral sound should be passed twice a week.

There is always a tendency toward recovery with the growth of the child.

Incontinence of Old Age.—This is chiefly found in women who have borne children and who have a laxity of the perineum and of the vaginal walls. Combined with this decrease in mechanical support of the bladder there is also a decrease in muscu
of the sphincter. The result is the inability to retain

a few ounces of urine, so that it escapes upon coughing or motions which increase the intra-abdominal pressure. In other cases a urethral polyp or caruncle may be at fault.

Relief is to be looked for in operations which restore the integrity of the pelvic floor. Sometimes a pessary, by preventing displacement or prolapse of the uterus, will render good service. Abnormally acid or alkaline urine should be brought to a normal reaction. Urethral polyp or caruncle should be removed by operation (see p. 270).

Catheterization.—A few words upon the best way to perform this simple act may not be out of place in this connection. It is practically impossible to sterilize the meatus and urethra, so that patients whose condition requires catheterization for months or years usually succumb to infection of the bladder and kidneys. Nevertheless, the advantages of cleanliness are here very marked. Rubber catheters should be boiled or scalded with boiling water after being used, and kept in weak antiseptic solutions until wanted. They should then be rinsed with boiled water and lubricated with a sterile medium. The meatus of the patient, as well as the hands of the catheterizer, should be carefully disinfected. In fact, it is better to use rubber gloves, which can be readily disinfected by boiling. As gloves for this purpose need not be very thin, they will last a good while. As soon as a rubber catheter loses its smooth surface it should be replaced by a new one.

When one calls to mind the fact that men have catheterized themselves for years, carrying a rubber catheter around in the vest pocket, and perhaps never washing it, and have still escaped infection, such precautions as have been above described may seem unnecessary. They are not so, however, and while some persons possess great power of resistance to disease germs, others fall an easy prey, and should be protected as far as possible.

Eczema.—The external genitals, both penis and scrotum, are favorite sites for eczema (Fig. 116). This condition is often due to or aggravated by uncleanliness or the larger or smaller parasites (scabies).

Chancroid.—A chancroid is a small ulcer appearing on the head of the penis, or foreskin, or possibly on the skin of the penis or scrotum, or even of the thigh. It is due to infection by direct contact with a virulent venereal discharge. Presumably some slight break in the skin allows the poison to gain a foothold. Such a lesion makes its appearance within a day or two after inoculation. It usually grows larger for several days, and may encircle the penis and eat away a considerable portion of its substance; but such rapid destruction is uncommon and the typical ulcer has the diameter of a quarter or half an inch. There may be more than one ulcer, either because the skin has been inoculated in more than one spot or because of autoinoculation from point to point. This explains the occurrence of ulcers upon the scrotum or thighs. The ulcers are usually shallow, not extending below the cutaneous layer. There is a certain amount of surrounding inflammation, and often lymphangitis and lymphadenitis; the vessels leading to one or both groins carrying the infection into the inguinal glands (inguinal adenitis or bubo). The lesions in both skin and glands are painful, and there is the constitutional disturbance

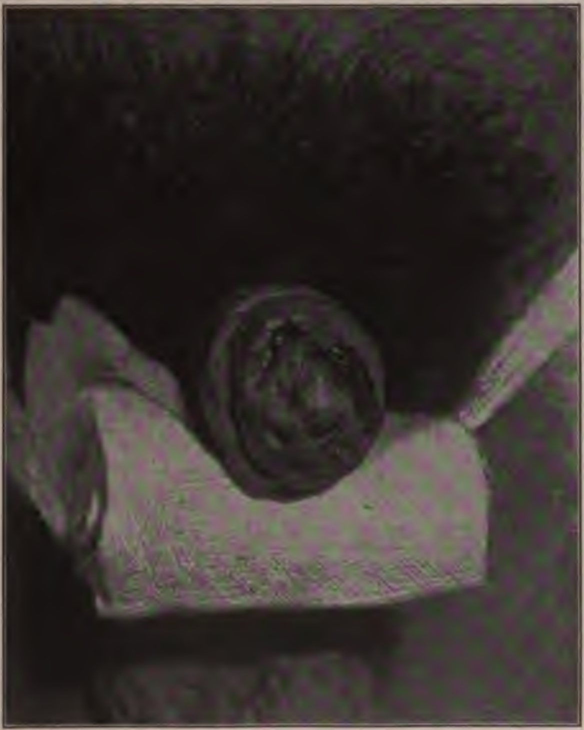


FIG. 116.—ECZEMA OF THE PENIS OF FOUR MONTHS' DURATION.

always seen in the presence of acute infection. The primary sore, unless some caustic has been applied to it, lacks the surrounding induration of a primary syphilitic lesion. If the chancroidal ulcer has been cauterized a differential diagnosis is more difficult.

TREATMENT.—A chancroid is best treated by a local hot bath two or three times daily, followed by careful cleansing with an antiseptic solution, such as peroxid of hydrogen diluted with four parts of water. Absorbent cotton, wet with a solution of zinc sulphate 1 to 60, or some other lotion, may either be held in place by drawing the foreskin over it or by a bandage. In the latter case the dressing should be moistened, without removing it, every hour or two to facilitate discharge. Surrounding skin should be protected against contamination and the patient advised of the high degree of infectiousness of the discharge. By this treatment pain will be much relieved, the ulcer will soon take on a healthy appearance and will heal in two or more weeks, according to its size and the condition of the patient. The use of strong caustics is never advisable. Excision of the lesion and suture of the wound often fails to give primary union.

TREATMENT OF BUBO.—The inguinal glands, if moderately inflamed, may be treated by counter-irritants; e. g., equal parts of belladonna ointment and an ointment containing ichthyol ʒj to vaseline ℥j. This is more likely to succeed in glands swollen from non-venereal causes. If pain and swelling are severe the patient should go to bed and apply an ice-bag or hot moist compresses to the groin. If the glands suppurate, as they usually do, the individual abscesses may be opened or the glands entirely dissected away. If the abscesses are simply incised and drained, the patient will require to be dressed for several weeks, but he will be able to go about without much discomfort. Complete removal of the glands seems a formidable procedure, but in about one-half of the patients so operated upon primary union of the parts may be obtained. This enables the patient to go home, entirely well, after ten days or two weeks of hospital treatment. If primary union is not obtained, the time of healing is probably no longer than would have been the case had a simple incision been made. According to the writer's experience, primary union may be reasonably expected if the skin overlying the glands is not affected. If, however, there are minute abscesses in the roots of the pubic hairs, primary union need not be hoped for.

Syphilis.—A chancre is the primary lesion of syphilis and may occur anywhere upon the surface of the body. Since it is contracted by direct contact with another individual suffering from syphilis in an acute stage, the primary lesion in the male is usually found at the meatus or upon the head of the penis or in the more delicate part of the foreskin just behind the corona; but it may also arise in the tougher skin of the penile body (Fig. 117). It is noticed, in most cases, ten days or two weeks after infection. In some cases an interval of four weeks or more elapses. The lesion is then a small indurated nodule in the skin, with only a slight loss of epithelial covering. The ulcer increases somewhat in size in the ensuing weeks, but if uncomplicated it never grows very large and is not very painful. It heals slowly and the induration lasts for many weeks after the ulcer has completely cicatrized. This is one of the chief points in the differential diagnosis between a chancroid and a chancre. The inguinal glands are usually somewhat enlarged, but they are not as tender as they are in connection with a chancroid, nor do they suppurate.

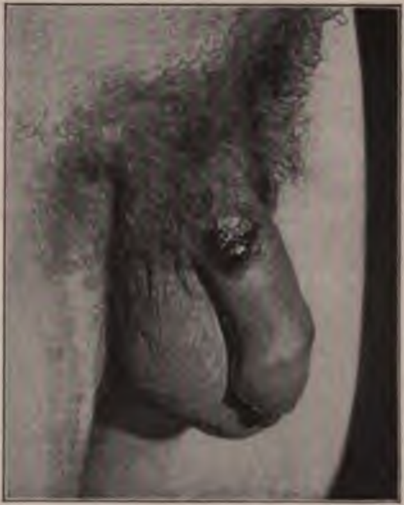


FIG. 117.—PRIMARY LESIONS OF SYPHILIS IN A PATIENT AGED SEVENTY-FOUR YEARS. Diagnosis made from microscopical examination confirmed by subsequently obtained history.

TREATMENT.—An uncomplicated chancre needs little treatment; it may be dusted with calomel or covered with mercurial ointment or some simple ointment. Constitutional treatment is required to cure the disease, and, for obvious reasons, such treatment ought to be withheld until such diagnosis is absolutely certain, that is, until the micro-organism has been demonstrated in the serum from the lesion (spirocheta pallida) or secondary manifestations of syphilis have appeared. Resection of the chancre has been practised in the hope of preventing the syphilitic infection from gaining access to the body; but such treatment does not achieve this result for the obvious reason that the syphilitic virus has plenty of time to be absorbed before the surgeon has an opportunity to remove the primary sore. The constitutional treatment is all-important (see p. 61).

Mixed Infection.—A chancroid and chancre may be combined, that is, both sorts of infection may enter the body at the same point. In this case the lesion will present the hardness of the chancre and the acute virulence of the chancroid, and the inguinal glands may or may not suppurate. An ulcer of this mixed character is much more difficult to heal than a simple chancroid, and it may eat away a considerable portion of the head of the penis before its processes can be stopped. A patient in this condition requires all the help which can be obtained from the best hygienic surroundings and food. The local treatment is substantially that indicated for a chancroid. The healing process is slow, and it may be advisable to change from one kind of dressing to another, as the stimulating effect of any one application grows less with its continued use. These mixed infections are often puzzles in diagnosis until secondary syphilitic lesions appear. Previous to that time it may be impossible to say whether the induration is due to the virulence of the infection or to the coexistence of syphilis. If the spirochetæ can be demonstrated in the discharge the question is at once settled.

Secondary Lesions: Mucous Patches.—The usual papular lesions may appear on the penis and scrotum. If they are so situated as to be kept constantly moist by the apposition of cutaneous surfaces they may take on the characteristics of a mucous patch with a surface covered with a grayish, foul membrane, and possibly with hypertrophy of the base, giving a papillary form to the growth. Such lesions are much commoner upon the female genitals and about the anus. (See Fig. 131, p. 268, and Fig. 140, p. 300.)

Syphilitic Orchitis.—One form of late syphilitic lesion is the involvement of one or both testicles—syphilitic orchitis (Fig. 118). This may take place a few months after the primary lesion, or at any time afterward up to many years. The only early subjective symptom is a feeling of weight or dull pain in the slowly enlarging testicle. This when examined is found to be uniformly indurated and enlarged. The enlargement involves chiefly the orchis, and the relatively small epididymis can usually be felt as a flat appendage at the rear. This is the common type of syphilitic orchitis, though occasionally the process is much more acute, and therefore painful; or distinct gummata may be noticeable from the beginning, giving the swelling a nodular character and probably leading to involvement of the skin and slough (Fig. 119). Similar gumma and ulceration may occur in the penis.

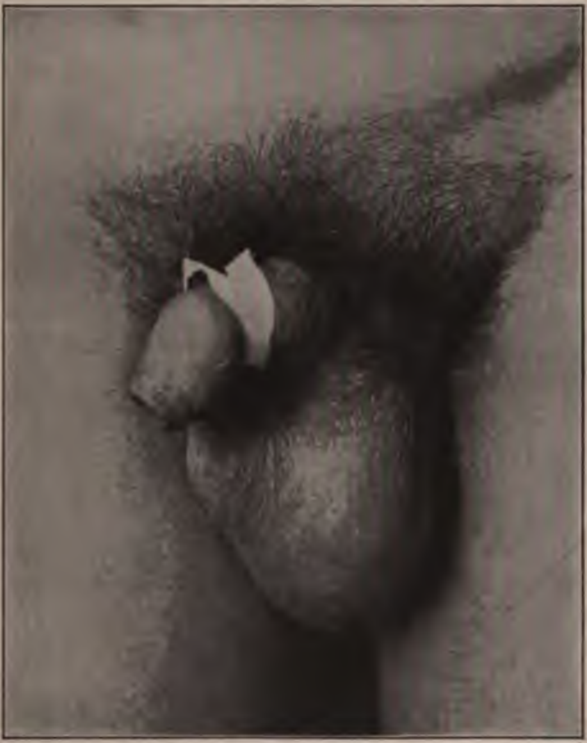


FIG. 118.—UNILATERAL SYPHILITIC ORCHITIS. Duration, six weeks. Patient aged sixty-eight years.

Syphilitic orchitis is a very slow process, both in its development and in its disappearance. It has one of three outcomes. It may entirely resolve, leaving the testicle as before. It may lead to atrophy of the testicle. It may ulcerate, and ultimately heal with more or less loss of testicular tissue and resulting scar formation. In this third form it is difficult to distinguish it from tuberculosis.

In the early stage of these two diseases the difference in location can usually be made out, syphilis affecting the orchis and tuberculosis beginning in the epididymis. In the later ulcerating stage this distinction may be impossible, because the swelling has so altered normal relations and because of the extension of the inflammation beyond its original site.

Another distinguishing mark of tuberculosis is the presence in most cases of several hard nodules due to separate foci of infection. Such are wanting in syphilis. If the tubercular nodules exist also in the vas deferens, the diagnosis is at once clear. Tuberculosis breaks down more promptly than a gumma, discharges more pus, tends to form flabby granulations, and has less wide-spread induration about a single center of infection.

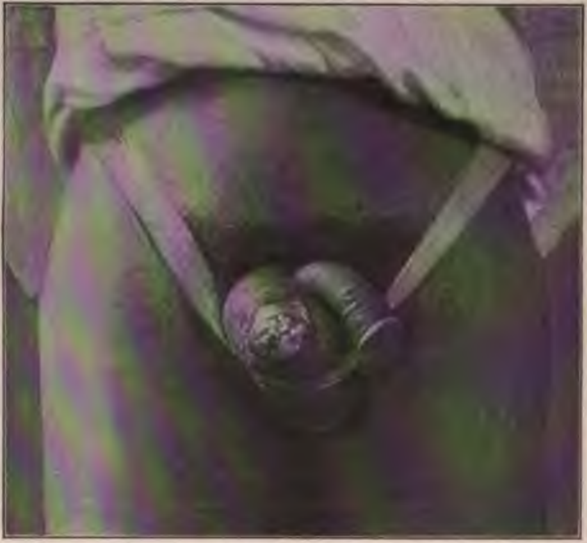


Fig. 119.—Syphilis of Testicle. Duration eight weeks. Ulceration through the skin of four days' duration: patient aged twenty-eight years.

Syphilis of the testicle must also be differentiated from malignant disease—either carcinoma or sarcoma. A malignant growth increases rapidly in size, is softer, produces great dilation of the blood-vessels, superficial and otherwise, involves the skin of the scrotum, and often breaks down, forming a gangrenous ulcer.

Treatment.—The patient should wear a suspensory bandage. Belladonna ointment may be applied over the swollen testicle. The only curative treatment is constitutional, and consists in the administration of iodid of potash, either alone or in combination with a mercurial.

Tuberculosis.—Tuberculosis of the genito-urinary system usually begins in the testicles in the male, although the kidneys, one or both, or rarely the bladder, may first show signs of the disease. Tubercular cystitis is one of the worst forms of disease a physician is called upon to treat.

Tuberculosis in the testicle sometimes follows a slight injury and sometimes develops spontaneously. Its early progress may be unnoticed, or there may be a moderate acute swelling, chiefly of the epididymis, which causes the patient a little pain. In either case the characteristic lesions soon appear. On palpation there will be found one or more moderately tender indurated foci in the epididymis. These are the tubercular nodules. As the disease progresses other nodules may appear either in the epididymis or in the cord, or in the corresponding seminal vesicle, as detected by the finger in the rectum. Possibly no nodule may be felt in the cord or seminal vesicle, these structures simply being harder and larger than those of the opposite side. The testicle itself increases in size, owing to the inflammatory products around the tubercular nodule. Still later the centers of one or more nodules may break down and resulting purulent and necrotic fluid may work its way to the surface and be discharged. A permanent sinus will result, discharging the watery, flaky, seropurulent fluid characteristic of tubercular sinuses.

Usually the disease is unilateral, although it sometimes happens that both seminal vesicles will be affected, while only one testicle shows signs of disease. In the beginning of the trouble the patient's health may be good. Later, a careful examination will usually show some evidence of tuberculosis in the lungs or elsewhere. The differential diagnosis of syphilis of the testicle is given above.

Treatment.—The appropriate treatment is an early and complete removal of so much of the diseased tissue as is accessible. If a single movable node exists it may be allowable to excise it without removing the whole testicle. Usually, however, unilateral castration should be performed and as much of the vas deferens as possible should be pulled out with it. No dangerous hemorrhage follows this so-called evulsion of the vas. To remove affected seminal vesicles through a perineal incision is a serious operation. If castration is early performed, and the patient is placed under constitutional treatment and lives out of doors as much as his circumstances will permit, his chance of complete recovery is a good one. I have known a patient with limited means to effect his own cure, after both testicles had become affected, by spending almost the whole of his waking hours in the streets of New York. Some surgeons recommend the injection of ten per cent iodoform emulsion in cases in which both testicles are involved. Such treatment is inadvisable. The retention of the testicles may spare the feelings of the patient, but it lessens the chance of a cure; and even if the process is overcome, the functional activity of the testicles will be almost or entirely effaced by the extensive scar tissue.

CHAPTER IX

TUMORS AND DEFORMITIES OF THE MALE GENITO-URINARY ORGANS

CYSTIC TUMORS OF THE EXTERNAL GENITALS

Cysts of the Skin.—A retention cyst containing serum or sebaceous material may be found in the skin of the penis (Fig. 120) or scrotum.

Sebaceous material retained back of the corona in children with long, narrow foreskins frequently becomes encysted. The overlying epithelium in these cases is thin, and can be wiped away

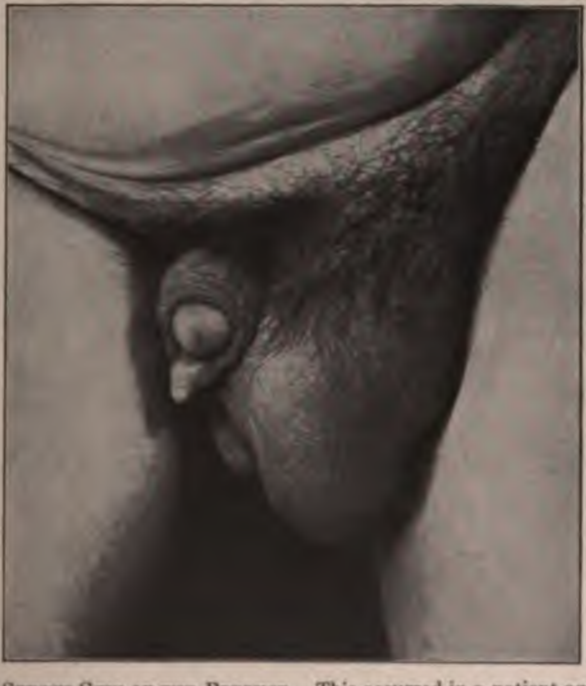


FIG. 120.—SEROUS CYST OF THE PREPUCE. This occurred in a patient aged fifty-five years, who had a large left inguinal hernia.

with gauze as soon as the foreskin is fully retracted. Deeper collections of epithelial cells and sebaceous material may also form in this region (Fig. 121), possibly on account of inexact approximation of the edges of epithelium after circumcision.

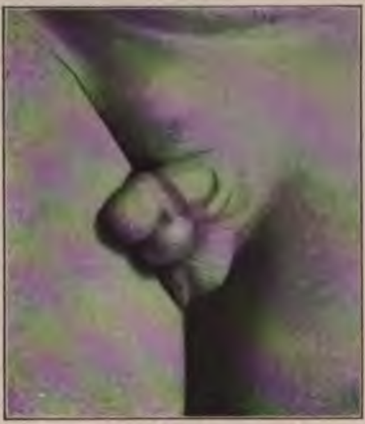


FIG. 121.—CYST OF PREPUCE FOLLOWING CIRCUMCISION IN A PATIENT OF FOUR YEARS OF AGE.

The scrotum is also a common seat of milia (see p. 66).

TREATMENT.—Smaller cysts may be evacuated and their cavities allowed to granulate; but a better plan for them and for larger cysts is the removal of the lining membrane and suture of the incision in the overlying epithelium. Compare the operation for sebaceous cysts of the head, given on page 68.

Cysts of the Testicle.—Retention cysts of the testicle are not so very rare. They are usually round, tense, fully movable, and situated in or near the upper end of the epididymis. Anatomically they may be connected with the testis or epididymis or the fetal remains of this vicinity, the paradidymis so called. They rarely reach an inch in diameter, and are usually single, but may be multiple. The contained fluid is pearly or whitish, and occasionally contains spermatozoa. Such a cyst in all but the contained fluid closely resembles a hydrocele of the cord (see p. 240).

TREATMENT.—Aspiration is usually performed to establish the diagnosis. It may be followed by the injection of a few drops of carbolic acid or the cyst may be dissected out through a short scrotal incision.

SOLID TUMORS OF THE EXTERNAL GENITALS

Papilloma.—Multiple papillomata of the penis are often called venereal warts because they may follow an attack of gonorrhea, though not necessarily so. They are usually found in the uncleanly or those who are unable to retract the foreskin, and are situated in the neighborhood of the corona. They are small, sessile or pedicled, and generally multiple. They cause no pain, do not lead to ulceration, and annoy the patient merely by their presence. The best treatment is to snip them off with a pair of sharp scissors, and to cauterize the stumps with a little chromic acid after the bleeding has been stopped by pressure. These warts may also occur about the anus.

Epithelioma is by far the most common form of malignant disease connected with the external genital organs. It usually begins near the corona, either upon the mucous membrane of the penis or foreskin (Fig. 122). It may, however, occur about the meatus. It may also begin in the scrotum, especially in the case of workers in paraffin and those who become covered with soot. Hence the name "chimney-sweep's cancer." It presents the characteristics of epithelioma of the skin in any part of the body. Upon the head of the penis it usually begins to grow upward before it ulcerates so that it looks like a wide-spreading wart, but sooner or later it will lead to hemorrhage and ulceration and present more nearly the usual picture of cancer.

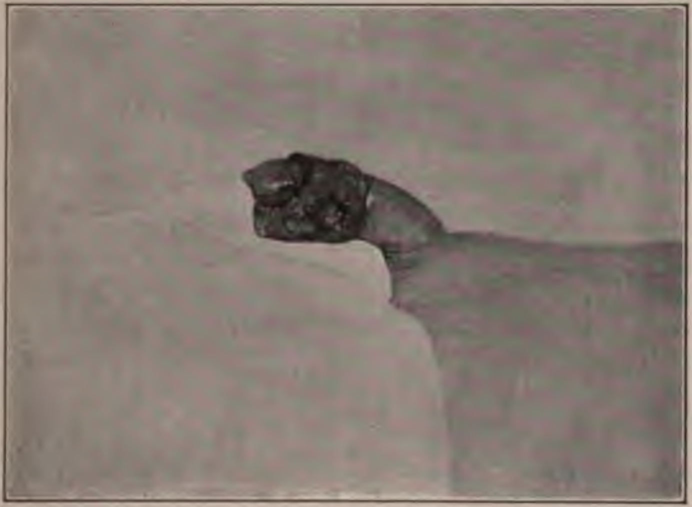


FIG. 122.—SQUAMOUS CELLED CARCINOMA OF PENIS.

If the foreskin is retractable a mistake in diagnosis is scarcely possible. If there is felt through an irretractable foreskin a hard, tender mass in the vicinity of the corona, the foreskin should be at once incised so as to allow of its retraction and an accurate diagnosis.

The lymphatic inguinal glands may not become affected for some months after the appearance of the tumor in the penis. This justifies the hope that an early excision of the disease will completely effect a cure, and statistics show that this hope is a reasonable one.

TREATMENT.—The treatment of cancer of the penis is, of course, its early removal. This necessitates amputation of the penis in nearly all cases. The glands in both groins should also be removed.

Epithelioma of the scrotum, if small and freely movable upon the underlying tissues, is easily excised. Owing to the great flexibility of the tissues there is no excuse for not removing with the tumor a wide margin of apparently healthy skin. The lymphatic glands likely to be involved in cancer of the scrotum are those of the inguinal region. They should also be removed.

Sarcoma or Carcinoma of Testicle.—Malignant disease of the testicle is not so very rare. It is of the utmost importance to recognize it early. In the early stages of the disease the testicle is swollen, smooth, but much harder and heavier than normal. There is little or no pain, but a sense of weight. As the disease progresses it may infiltrate the surrounding tissues and involve the skin. Even before this the superficial vessels are much dilated.

Sarcoma or carcinoma is easily distinguishable from hydrocele by the light test. This is the more important as a vascular tumor will often give a feeling of fluctuation, but no matter how vascular it is there will be little or no translucency. It should be borne in mind that hydrocele may be secondary to this and other severe lesions of the testicle. The collection of fluid is usually small, and ought in no instance to conceal the severer lesions from a careful observer.

Sarcoma and syphilis have many points in common. The history of syphilis as opposed to that of injury, and the beneficent effect of treatment by potassium iodid as opposed to a continued growth in spite of treatment, are aids in differential diagnosis (see also p. 228). Treatment consists in the immediate removal of the affected testicle, with cord and inguinal glands.

Castration.—This operation may be performed under a local or a general anesthetic. The latter is preferable in malignant cases, as the dissection should then be carried well up into the groin.

In non-malignant cases the skin of the scrotum should be cleansed and shaved, and the penis wrapped in gutta percha tissue or sterile gauze. An incision parallel to the cord should be made from the external ring downward for an inch or more. After division of skin, cremaster, and fascia, the testicle can be brought out of the wound. If there is any doubt as to the nature of the disease, the testicle should be incised. If it is decided not to remove it, the incision may be sutured. This step is important, for castration has been performed in cases of hematocele and even hydrocele, a wrong diagnosis having been made.

The attachment of testicle to the bottom of the scrotum is next to be divided. The testicle is then withdrawn from the wound and removed with so much of the cord as conditions make necessary. There are three arteries to ligate—the cremastric, the spermatic, and the artery of the vas deferens—and several veins. The stump of the vas may be touched with carbolic acid, or a cautery in infective cases. Skin involved by disease should be removed and healthy skin sutured. If a small gutta percha drain is placed in the lower angle of the wound or through the bottom of the scrotum, it should be removed in two days, or as soon as the serous flow becomes scanty, so that a sinus may not be formed.

TUMORS OF THE BLADDER AND PROSTATE

Tumors of the Bladder.—Tumors of the bladder may be either benign or malignant. They are apt to be papillomatous, and first attract attention either by obstructing the flow of urine or by giving rise to hemorrhage. Their diagnosis and treatment are often extremely difficult, and form an important chapter in major surgery.

Tumors of the Prostate: Prostatic Hypertrophy.—Tumors of the prostate are rare unless one considers as a tumor the chronic enlargement of the prostate so often found in men past middle age. This may remain unnoticed until its infringement on the urethra causes delay in starting the stream, a feeble stream, and dribbling at the end. Where enlargement is more marked symptoms of urethritis and cystitis are added, and sooner or later the patient is likely to suffer from inability to pass water. Hence prostatic hypertrophy ought always to be borne in mind under such circumstances if the patient is over forty years of age. If the enlargement is not too great or does not press forward too sharply against the urethral canal, a soft rubber catheter can usually be passed to the bladder and the patient be thus temporarily relieved. If this is not possible the surgeon may succeed in passing a silver instrument bent in an extra large curve, the so-called prostatic curve. Failing in this, he must resort to some of the measures spoken of under the caption "Retention of Urine" (p. 219). In the early stages of this difficulty, the administration of urotropin or one of the various manufactured medicines which contain it, will often cause the prompt disappearance of the symptoms. The relief thus obtained is, of course, not permanent, but it may last some weeks or months. When the prostatic enlargement again forces itself into notice, daily catheterization and irrigation, or cauterization of the prostate through the urethra (Bottini's method), or prostatectomy carried out through a suprapubic or perineal incision must be considered. The description of these operations will be found in detail in books on major surgery. Castration was at one time extolled as a means of reducing enlargement of the prostate, but it has not proved successful in most cases.

ACQUIRED DEFORMITIES

Hydrocele.—Hydrocele is an accumulation of fluid in the tunica vaginalis (Figs. 123 and 124). It may occur at any age and be unilateral or bilateral. It may follow an injury or may accompany inflammatory conditions, but in most cases no cause for it is apparent.

Diagnosis.—Symptoms, if any, are due to the increased weight which drags upon the cord. Usually a hydrocele is readily recognized. If the accumulation of fluid is moderate, there will be felt alongside of and partly overlapping the testicle a flabby, fluctuating cyst. If the accumulation of fluid is greater, the tunica will be distended, and the cyst thus formed will be tense and fluctuating, while the exact location of the testicle may be uncertain. If the tunica is fully distended the whole swelling is pear-shaped, the small end being upward. A fluctuation wave is easily obtained if the mass is grasped in one hand and tapped with a finger of the other hand first in one place and then in another.

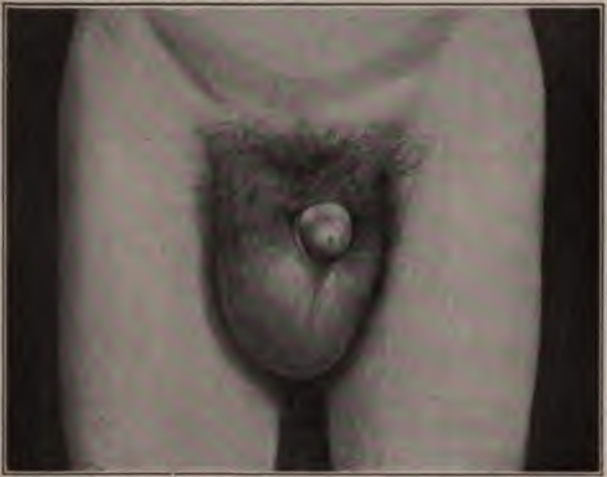


FIG. 123.—SMALL HYDROCELE. Duration four months. Patient aged sixty-two years.

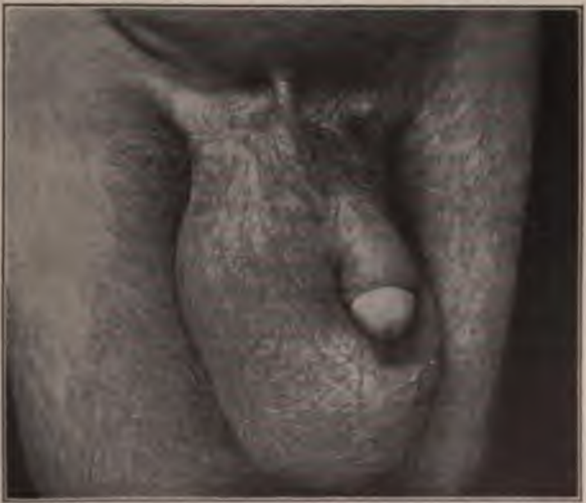


FIG. 124.—HYDROCELE OF TEN YEARS' DURATION. Growing most in the past two years. Never treated. Patient aged fifty-seven years.

A hydrocele may usually be diagnosed by palpation. Occasionally, however, even the most skilful fingers will be deceived, so that in every case the light test should be employed. This depends upon the fact that light is more readily transmitted through serum than through a blood clot, a hernia, a swollen testicle, or a fleshy tumor, these being the conditions most likely to be mistaken for hydrocele. The test is applied as follows: A tube about a foot long and one inch or less in diameter is pressed against one side of the elevated tumor, while the surgeon puts his eye close to the other end of the tube. A light is so held that its rays may pass through the tumor and tube to the eye of the surgeon. Daylight may be employed for this purpose, but is by no means so accurate as concentrated artificial light. This test will serve not only to distinguish a hydrocele from other swellings, but will show the position of the testicle and will thus enable the operator to avoid it in thrusting in a trocar for the purpose of aspirating the fluid. The light test is more delicate when performed in a darkened room. (For diagnosis of hematocele see page 204.)

Hydrocele differs from hernia in that the inguinal canal is empty, there is no cough impulse, the tumor is irreducible, yields an exquisite wave of fluctuation, and generally transmits light. Hernia and hydrocele may coexist.

A chronic hydrocele is differentiated from an inflamed testicle by its fluctuation and translucency, and by the presence of the normal uninflamed testicle, and by the absence of pain. An acute hydrocele is often a result of inflammation or injury of the testicle, but the amount of fluid is small in these cases.

Hydrocele is differentiated from a solid (usually malignant) tumor by the absence of pain, by the better wave of fluctuation, and by translucency. Moreover, the solid tumor will weigh more in proportion to its size and will produce dilatation of the blood-vessels and possibly enlargement of the inguinal glands. A final diagnostic test is the aspiration of serous fluid.

Treatment.—The simplest treatment for hydrocele is the aspiration of its contents. As the fluid usually reaccumulates in a few weeks, it is better in every instance after the aspiration of the fluid to inject a small quantity (five to thirty minims, according to the size of the hydrocele) of tincture of iodine or pure carbolic acid. This causes for a few minutes a burning sensation which is not unendurable. In a day or so, owing to the effect of the irritation, the testicle and tunica may swell until the tumor is almost as large as before aspiration. The swelling gradually decreases, however, and in a majority of instances the hydrocele does not recur. The patient should be informed of this inflammatory reaction, otherwise he may believe that the hydrocele has promptly recurred and will probably seek other medical advice.

The aspiration and injection can easily be performed at the surgeon's office as follows: The patient should lie on his back. The scrotum should be carefully washed and made surgically clean. It should be supported and distended by an assistant, while the surgeon plunges the needle of a hypodermic syringe into the tunica at some point far removed from the testicle, which ordinarily lies in the lower posterior portion of the tumor. Serous fluid will immediately flow from the needle, which should be left in position, as the iodine or carbolic acid is subsequently to be injected through it. A small sized trocar and cannula are thrust into the tunica near the hypodermic syringe. The trocar is withdrawn and the hydrocele fluid allowed to escape. The hypodermic syringe containing the fluid to be injected is then screwed on to the hypodermic needle and the injection is slowly made. The cannula and hypodermic needle are then withdrawn and the punctures covered with a little gauze, which is strapped to the scrotum and a suspensory bandage is applied. The advantages of this method of procedure are two: the introduction of the hypodermic needle causes little pain and further confirms the diagnosis, while the presence of the two instruments enables the surgeon to be absolutely sure that their points are still within the tunica vaginalis before he injects the iodine or carbolic acid, for they can be rubbed together and will produce a distinct click. Another good plan is to tap the hydrocele with a small trocar, to withdraw the same, and when the fluid has run off through the cannula to pass through it a second still smaller hollow blunt needle affixed to the syringe containing the carbolic or iodine. In this way the dosage of the injected fluid may be made accurate, as none is lost in the cannula. Unless some such method is employed it may happen that the collapsed tunica retracts over the point of the cannula, allowing the injected fluid to pass into the scrotum outside of the tunica.

A hydrocele may recur after injection. This is the rule if a very small quantity of fluid is injected, but the reaction after a small injection is very slight, so that a repetition of the aspiration and the injection, perhaps three or more times, is not objectionable. By this treatment the patient loses no time from his business and there is always a good chance that the second or third injection may effect a cure.

Should a more radical treatment be desired, it may be carried out as follows: Make an incision through the skin of the scrotum anteriorly, parallel to the long axis of the body, extending from the upper end of the whole swelling to a little below its middle. It will be necessary to divide several layers of fascia and thin muscle (dartos) before exposing the tunica vaginalis. This should be incised throughout nearly its whole length. The fluid is fully evacuated, surplus portions of the sac are removed, and the edges of the sac so stretched to the edges of the skin that the sac remains open. Its cavity is filled loosely with gauze, and allowed to heal by granulation.

Another method of operating consists in the removal of the greater part of the parietal portion of the sac. The visceral portion should be lightly scratched with a needle to facilitate adhesions between it and the subcutaneous tissue. The wound may be closed either partially or wholly.

These severer operations require the patient to remain in bed for some days.

Unusual Types of Hydrocele.—In the hydrocele, as described above, the fluid collects in the normal tunica vaginalis. There are several other varieties of hydrocele.

Congenital Hydrocele.—The cavity of the tunica vaginalis may extend upward as far as the internal abdominal ring, or may even connect with the cavity of the perineum. Under such circumstances the opening is usually small, but pressure upon the hydrocele, if the patient is in a recumbent position, will cause the fluid to disappear into the abdominal cavity. It will reaccumulate when the patient resumes an upright position.

Hydrocele of the Cord.—Fluid may collect in some unobliterated portion of the peritoneal process which accompanies the descent of the testicle. This is called a hydrocele of the cord. A hydrocele of the cord may coexist with hydrocele of the tunica vaginalis, the two sacs being entirely distinct and possibly separated by an inch or more of normal cord, or the hydrocele of the cord may exist alone, or there may be more than one hydrocele of the cord.

The diagnosis of these conditions is sometimes easy, sometimes difficult. They are most likely to be confused with hernia. If the hydrocele extends into the inguinal canal an impulse in the tumor may be produced by coughing. Again, the possibility of reducing the fluid into the peritoneal cavity may be misleading, but the fact that it reaccumulates when the patient stands upright, even though the finger of the surgeon be lightly pressed upon the external ring, will usually suffice for a correct diagnosis. A hernia may coexist with a hydrocele, and here again the diagnosis may be easy or difficult (see pp. 194 and 238).

If the hydrocele of the cord is situated low down, it may be impossible to differentiate it from a cyst of the epididymis except by aspiration. The fluid in these cysts is pearly or milky white, while that in a hydrocele is straw-colored.

TREATMENT may be by aspiration and injection of a few drops of carbolic acid or iodine; but on account of the difficulty of exact diagnosis in many of these cases, it is better to expose the sac through a short skin incision, to dissect it free and to remove it, and suture the wound. In this way one avoids the chance of doing injury by aspiration and injection. It is better that the patient should go to bed for a week or two, with a reasonable certainty of cure, than that he should be subjected to danger because the surgeon is working in the dark.

Varicocele.—Another common abnormal condition within the scrotum is varicocele. The essential feature of varicocele is a lengthening, dilatation, and contortion of the veins accompanying the spermatic cord (Figs. 125 and 126).

Varicocele is almost exclusively found upon the left side. A number of reasons have been given to explain this. It has been pointed out that the left spermatic vein is longer than the right and empties into the left renal at a right angle, whereas the termination of the right vein is in the vena cava, and the angle is oblique.

It seems probable that modern clothing has something to do with the development of varicocele on the left side. The almost invariable habit men have of placing both testicles and the penis in the left leg of the trousers may drag upon the left cord so as to interfere with its circulation. At least the writer has known the pain from a moderate varicocele to disappear soon after the patient made it a practice to put testicles and penis in the right leg of the trousers, thus giving the support of the seam to the weaker (left) organ.

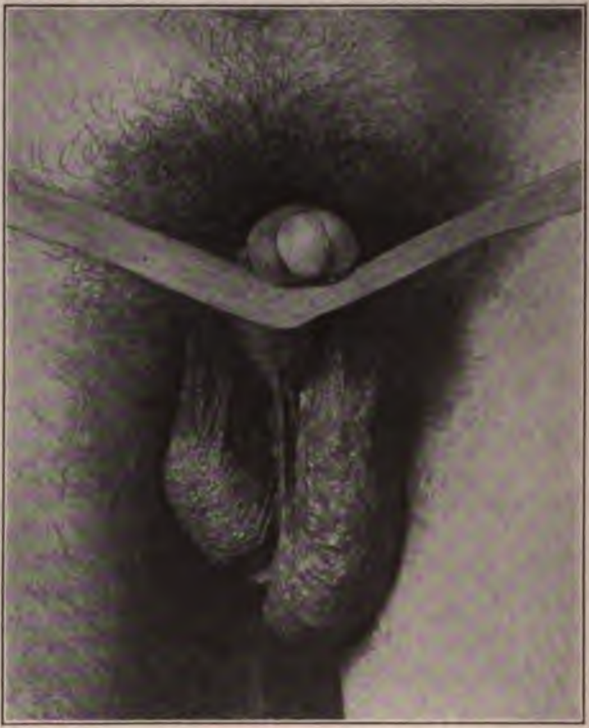


FIG. 125.—VARICOCELE OF MODERATE DEGREE. Duration, one year. Patient aged thirty-six years.

Keyes calls attention to the fact that varicocele is almost exclusively a condition of young unmarried men, and frequently disappears within a short time after marriage.

The veins first affected are usually situated just above the testicle or by the side of its upper portion. They may also extend well up to the external ring. A well marked varicocele has been aptly compared to a bag of earthworms from the sensation produced upon the palpating thumb and finger. If the veins are very large there may be some impulse on coughing. The size of the tumor will be considerably reduced when the patient lies down.

The symptoms produced in the patient are a dragging, heavy sensation, often associated with more or less constant pain in the testicle and cord, and possibly in the penis. Aside from this local discomfort the patient is often distressed by the thought that the continuance of the trouble will affect his virility. This does not appear to be true, although the atrophy of the corresponding testicle often seen in connection with a long standing varicocele suggest this idea. The scrotum will usually be found relaxed to an uncomfortable extent. These local disturbances, combined with the mental distress, often affect the general health of the patient.

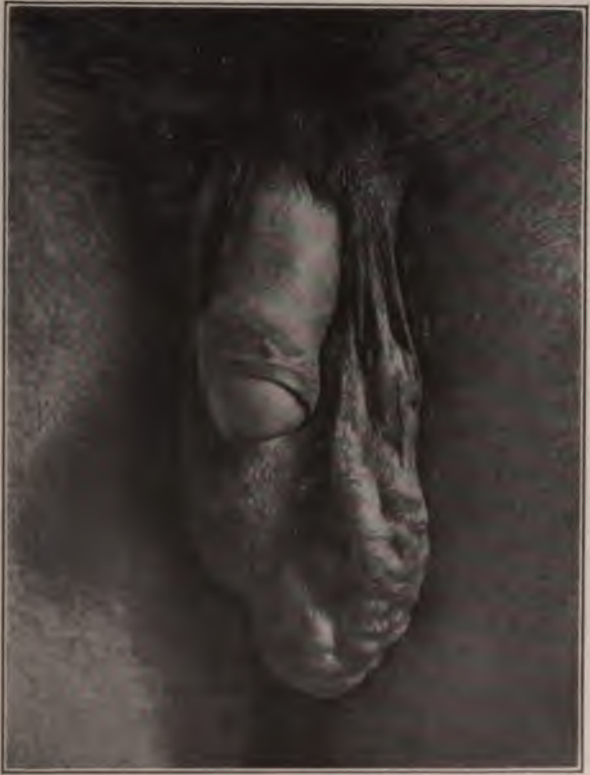


FIG. 126.—VARICOCELE OF EXTREME DEGREE. Veins unusually large and distinct. Duration, fourteen years. Patient aged twenty-nine years.

TREATMENT.—In many cases relief follows the use of a suspensory bandage, cold bathing and attention to the general health,

and particularly to the condition of the bowels. When these simple measures fail to bring relief, operation is indicated.

There are several forms of operation which have proved successful. They are all capable of easy performance under eucain or cocain, unless the nervousness of the individual makes a general anesthetic desirable. A short incision parallel to the cord is made over the upper portion of the dilated veins. The mass of dilated veins is separated from the surrounding tissues and ligated in two places and divided. Before the ligatures are tied the surgeon should convince himself that they do not include the vas deferens by actually feeling it outside of the ligature. A slightly more extensive operation includes the dissection of a part of or the whole mass of dilated veins and the careful ligation of their stumps. The upper and lower ligatures may be tied together, thus closing the gap caused by the removal of the veins and giving extra support to the testicle. The wound in the skin is sutured with fine black silk. If the scrotum is lax the above operation may be combined with removal of its most dependent portion. The major part of the excision should take place on the affected side. The wound is fully sutured. It makes no difference in which direction the suture line in the scrotum runs.

Although these operations are simple and the patient can walk home after their performance, it is better for him to go to bed before operation and to remain in bed for a few days afterward to avoid bringing strain upon the parts and to lessen the risk of hemorrhage, always an unpleasant complication when it occurs in the loose tissues of the scrotum.

The after-treatment consists in the wearing of a suspensory bandage for a time and attention to the general health. There is seldom recurrence, especially if a considerable part of the dilated veins have been removed.

CONGENITAL DEFORMITIES

Phimosis.—The commonest malformation of the male genitals is phimosis. The foreskin may or may not be of unusual length. Its opening is too small to permit the retraction of the foreskin over the head of the penis (Fig. 127). It may be so small as seriously to interfere with the passage of urine. If the

opening is minute the sebaceous secretion around the corona does not readily find an exit, and the slight irritation produced by its presence often causes adhesions between the mucous membrane of the head of the penis and the inner layer of the foreskin. Sometimes these adhesions are easily broken up, sometimes the two layers of epithelium are so firmly grown together that one or the other is torn away in the complete retraction of the foreskin. In a more serious degree of phimosis the entire space between the head of the penis and the foreskin is obliterated, and the skin covering the penis is attached directly around the meatus.

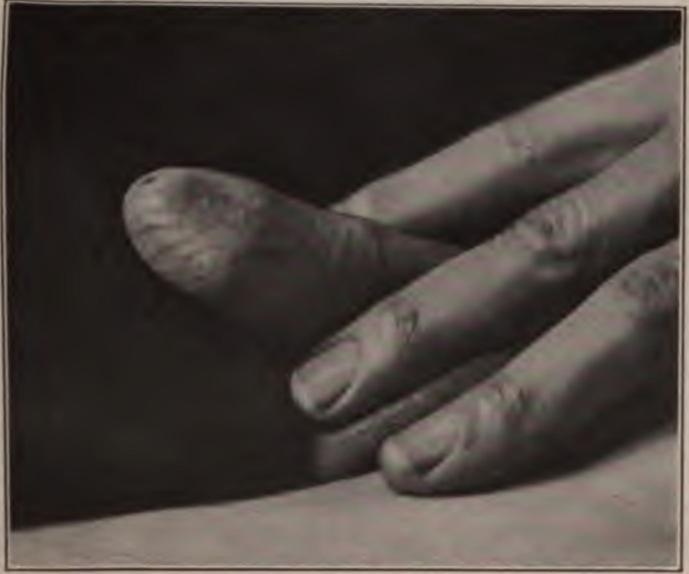


Fig. 127.—Tight Phimosis; Congenital. Patient aged sixteen years.

Treatment.—At birth the foreskin is so thin and elastic that even though its opening is very small, it can usually be forcibly retracted. If gauze is employed to prevent the foreskin from slipping through the surgeon's fingers, less force is necessary. The passage of a thin, flat probe between the foreskin and the glans penis will be found useful in breaking up any existing adhesions. Or the foreskin may be drawn forward and its opening enlarged by inserting in it the beak of a pointed closed artery forceps, and then separating the blades. The foreskin should then be retracted and the head of the penis smeared with a bland ointment to prevent

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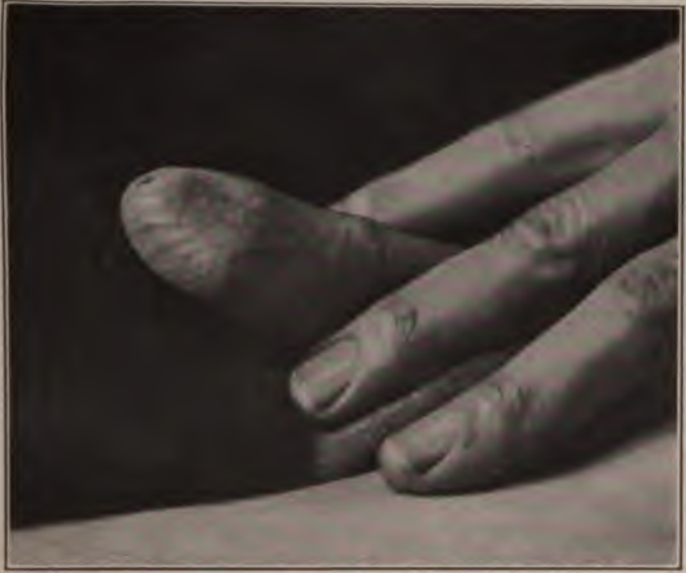

FIG. 127.—TIGHT PHIMOSIS; CONGENITAL. Patient aged sixteen years.

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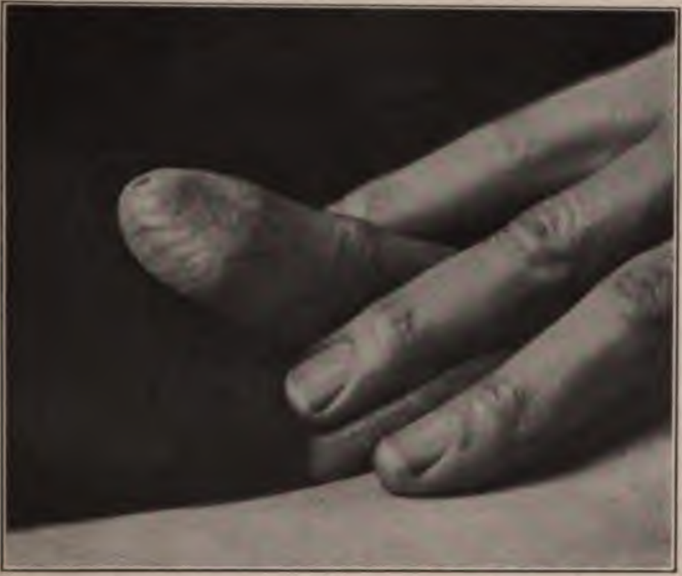

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the formation of adhesions. The foreskin should then be again drawn over the glans, and never left retracted lest paraphimosis be produced (p. 205). This treatment should be repeated every few days until the tendency toward retraction is outgrown.

Operative treatment for phimosis consists in making a dorsal incision or two lateral incisions through the foreskin so as to increase the size of the orifice; or in the removal of a wide circle of skin about the orifice. This last operation is called circumcision.

Incision of the Foreskin.—A dorsal incision is a temporary expedient to be resorted to in the presence of inflammation or edema, especially when the foreskin has been drawn back beyond the corona of the glans and cannot be brought over it again. It leaves an unsightly deformity, and should always be considered merely a temporary measure. It is performed as follows:

If the foreskin is retracted, the tightest portion is obscured between the looser folds of skin of the inner and outer portions of the prepuce. These roll up in two rings of edematous skin. By separating them the tense constricting ring will be revealed. A few drops of cocain solution should be injected, and as soon as anesthesia has developed the tight ring should be seized with mouse tooth forceps and cut through with scissors or a scalpel, and the incision continued upward and downward sufficiently to enable one to draw the foreskin down over the head of the penis. When this is done it is easier to estimate the amount of division which is necessary. In general the inner layer of the foreskin should be divided to the corona; the outer layer not quite so far.

If the foreskin is not retracted, as in many cases of chancroid, the injection of cocain should be made along the line of incision, first in the outer layer of the prepuce and then in its reflected layer. The blunt point of a pair of straight scissors should then be passed between the head of the penis and the foreskin, and both layers of the latter split up for half an inch. The foreskin should then be partially retracted, and a second cut made in the inner layer of the foreskin so that its division shall be carried back to a point opposite the corona. This will enable the foreskin to be fully retracted. The operator must then judge as to the necessity of any further division of the outer layer, or of the wisdom of an immediate circumcision. This should certainly be performed in non-infective cases, and probably in many of the infective ones as well.

Two lateral incisions are made in a similar manner to the single dorsal incision. It is claimed for this method that it is never followed by a great edema around the frenum, which is often such an annoying sequel of the dorsal incision.

Circumcision.—This little operation can be performed in a number of ways. The practise among the Hebrews when circumcision is performed as a religious rite is to draw the foreskin well forward, to cut it off with one stroke of a long knife, to immerse the penis in wine held in the mouth of the rabbi to stop the hemorrhage, and then to wrap it in linen rags. It is not surprising that dangerous hemorrhage and infection sometimes follow this procedure, and a few lives have been lost in consequence.

Equally reprehensible is the practise among some surgeons of trying to perform this little operation in the shortest possible time. For this purpose clamps have been devised to hold the foreskin so that both the external and reflected portions can be cut away by a single stroke of the knife. It is obvious that the amount of skin thus removed cannot be controlled with certainty, and even if the line of incision be a perfectly smooth circular one, a thing which rarely happens, the adjustment in length of the external and internal portions of the prepuce is at best uncertain. There is no part of the body concerning which most patients are more sensitive, so that the surgeon ought to be willing to give up a few minutes of his time in order to secure a perfect result.

An extensive experience, both in the performance of this operation and in the observance of the operation as performed by others, has convinced the writer that a perfect result is most likely to be attained in the following manner: The patient, if a very young baby, requires no anesthetic, or ether may be given. A local anesthetic had better not be employed in patients under six or eight years of age, as it will not remove the fright of an infant or a young child. The parts should be carefully washed with soap and warm water and a weak solution of bichlorid of mercury, 1:2,000 or weaker. Two sharp nosed artery clamps should be fixed upon the orifice of the foreskin to the right and left of the dorsal median line. If the orifice is too small to permit this, it should first be snipped dorsally with a pair of scissors. Traction being made upon the clamps, the foreskin is drawn well beyond the head of the penis and one blade of a straight scissors is passed between the head of the penis and the foreskin. An incision is made which extends nearly back to the reflection of the foreskin (Fig. 128). In drawing the foreskin forward in this manner there is danger that its outer portion will be cut farther back than will its inner portion; hence, after the first clip of the scissors the traction upon the clamps should be relaxed and the reflected portion of the foreskin should be cut farther if necessary. Two clamps are then placed upon the orifice of the foreskin at its lower edge and an incision is made between them. This incision is far shorter than the dorsal one. The two clamps on the left side are then drawn outward and the left half of the foreskin is removed, care being taken that the incision through the inner layer of the foreskin shall be nearly parallel to the corona of the glans, and that the incision through the external layer shall be directly opposite to it when only slight traction is made upon the clamps. The best result is obtained when the portion of the inner layer which

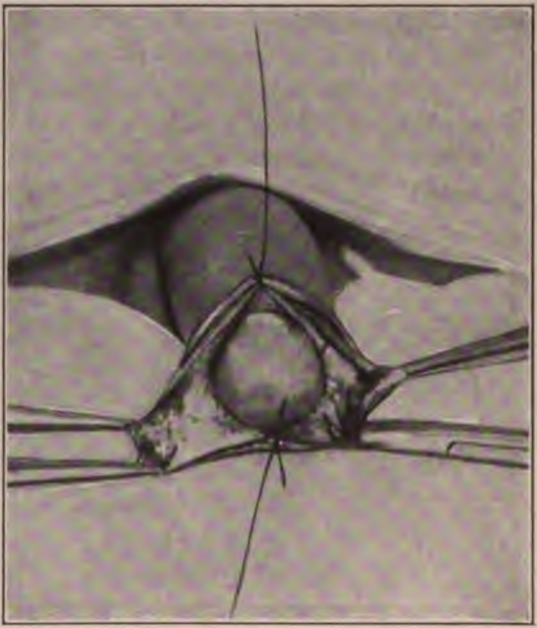

FIG. 128.—OPERATION FOR PHIMOSIS. Dorsal and ventral incisions and two tension sutures.

is left is a third or a half of an inch in width. The right half of the foreskin is next cut away. Any bleeding points are clamped and tied if necessary with very fine catgut. If the hemorrhage can be stopped by pressure, so much the better. The edges of the external and internal layers of the foreskin are then approximated by eight or twelve stitches of fine black silk (Fig. 129). The first one should be applied at the frenum, the second upon the dorsum of the penis, the third and fourth in the middle of the right and left sides respectively. In each of the four spaces thus marked off two or three stitches should be placed. When sutured in this manner the foreskin will not be drawn unevenly in any direction. If preferred, the stitch at the frenum and the dorsal stitch may be introduced before the sides of the divided foreskin are removed. These stitches, if left long, will serve as retractors. In infants no dressing is required, except a little sterile gauze placed between the penis and diaper. The mother should be told to keep the penis clean by letting a little cooled boiled water run over it after each urination. In four or five days the stitches should be removed.

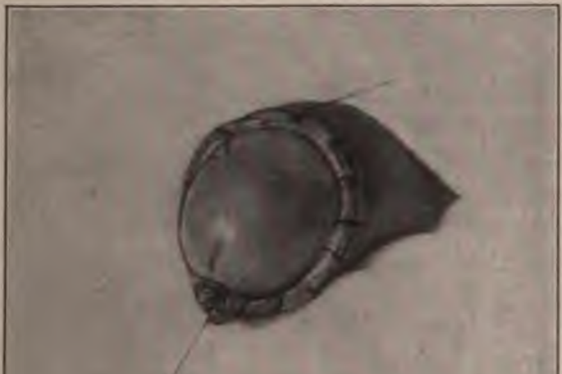

FIG. 129.—OPERATION FOR PHIMOSIS. Circular incisions complete; all sutures inserted.

Silk is better than catgut, for the latter gives way sometimes and is, besides, more irritating to the tender skin. In older persons the skin should be well retracted and a circular bandage of sterile gauze wound around the penis behind the glans. If this becomes soiled with urine it should be immediately changed. Attention on the part of the patient will usually prevent this accident. A good precaution is to lie down to urinate, turning almost upon the face. This prevents any backward dripping of the urine. Dressed in the manner described, the two cut edges of skin are closely approximated, and will unite with the minimum amount of adhesions.

COMPLICATIONS AND LATE RESULTS.—*Painful Micturition.*—The disability following a properly performed circumcision is very slight. There may be a little burning during the passage of urine for one or two times. In an adult, if an erection occurs, it will only be painful in case the dressing is too tight. It can be relieved at once by loosening or removing the bandage.

Hemorrhage is unlikely if all bleeding points have been ligated. If it does take place it is usually subcutaneous, and opportunity should be given for the escape of the blood through a gap in the skin incision. If bleeding is free, and is not controlled by digital pressure or cold, the skin wound should be opened sufficiently to permit proper ligation of the bleeding vessel. This does not delay complete repair nearly as much as the presence of a subcutaneous hematoma.

Edema is usually due to faulty technique, either malapproximation of the skin, tearing of the tissues, or hemorrhage beneath the skin. It shows itself chiefly about the frenum, and may persist long after the wound is healed. It will ultimately disappear. Its disappearance may be hastened by hot applications, counterirritants, pricking with a glover's needle, etc.

Infection.—If the wound becomes infected it should be drained at once by the removal of one or two stitches, by soaking the penis frequently in a mild, hot antiseptic solution, and by wet dressings of creolin 1: 200, borolyptol 1: 4, etc. Retraction is likely to follow the removal of stitches, so that in a suppurative case they should be allowed to remain until granulations have fixed the skin edges in contact.

Retraction of the skin of the penis, so that its cut edge is everywhere separated from the cut edge of the mucous membrane, takes place in some cases of infection; and sometimes without infection, if so much skin has been removed that there is undue tension upon the sutures. The immediate result is a circular band of granulations, over which new epithelium will creep in the course of a couple of weeks. The ultimate result is generally good, although the immediate result is so discouraging. The skin of the penis is capable of great stretching, so that erection is not permanently interfered with, even by the removal of too much skin.

Irregularity in Outline.—An uneven section of the skin should be corrected at the time of operation, but if not noticed then it is better to correct it by a subsequent operation than to allow a patient to go away dissatisfied. A common error is to leave too much skin at the frenum. This projects beneath the tip of the penis and catches the last drops of urine, besides being unsightly.

If circumcision is performed to aid the patient in overcoming the habit of masturbation, superfluous skin about the frenum should never be left, since it is most abundantly supplied with sensory nerves, and especially invites manipulation.

Recurrence of Phimosis.—If the inner layer is left long, say half an inch or more, and the suturing or the dressing has been carelessly done, it may happen that the inner and the outer layers of the foreskin will firmly unite for a distance of a quarter of an inch or more from their free edges. There will then be formed a strong band of cicatricial tissue completely encircling the penis, which by its contraction may so reduce the orifice of the foreskin as to render necessary a second operation.

Short Frenum.—The frenum should not take all the strain when the skin of the penis is retracted. If it is so short that it does so, the penis may be curved during erection, or erection may be painful, and normal coitus impossible.

Under such circumstances the frenum should be put on the stretch and pierced and cut with a sharp pointed knife, the edge of which is directed away from the penis.

Narrow Meatus.—The external orifice of the urethra may be narrow. This condition may be an accompaniment of phimosis or it may exist alone. The narrowing is not usually sufficient to interfere with urination, and it does not ordinarily come to the surgeon's notice until he has occasion to pass instruments or treat the patient for urethral discharge. It is then an interference and should be divided.

The narrowing of the meatus is usually due to an extension of the mucous membrane across the lower portion of the urethral orifice. Sensibility should be benumbed by the application of a drop of strong solution of cocain (ten per cent) or the hypodermic injection of a drop of a weak solution (one per cent). The web should then be divided by a blunt pointed narrow knife sufficiently to make the caliber of the meatus fully as great as that of the urethra. The patient should soak the end of the penis in hot saline, and separate the lips of the meatus once every day to prevent them from reuniting. The surgeon should pass a full sized sound through the meatus twice a week for two weeks, to insure the full benefit of the operation.

Hypospadias.—This malformation consists in a defect in the lower portion of the urethra, so that the urine is passed through a fistula in the glandular penile or perineal urethra. Usually there is an absence of urethra distal to the fistula. There is often an accompanying flattening of the head of the penis or a downward curving of the whole organ.

TREATMENT.—If the opening is not farther back than the middle of the pendulous portion of the penis, a complete restoration of function, both urinary and procreative, may be obtained by a simple plastic operation. The gutter which marks the site where the urethra should be may be covered by skin flaps cut from the edges of this gutter and turned over a small catheter. The raw surfaces of these flaps may be covered by the remaining skin of the penis or in some cases by flaps from the prepuce, if any prepuce is present.

Another plan of treatment is to free by dissection the existing urethra, to puncture the blind distal portion of the penis, and to bring forward through the artificial canal thus made the dissected urethra. Its elasticity permits it to be stretched to twice its normal length. The details of these ingenious operations, and others adapted to the more serious cases of fistula of the deeper urethra, will be found in text-books on major surgery and genito-urinary surgery.

Epispadias and Exstrophy of the Bladder.—In epispadias the urethra opens upon the dorsal surface of the penis. This condition is often associated with exstrophy of the bladder, which renders a perfect restoration of function by means of operation well-nigh impossible; and the patient is compelled to resort to the constant use of a urinal.

Undescended Testicle.—One or both testicles may be absent from the scrotum, either in infancy or adult life. There is rarely a failure of the testicles to develop, but usually the testicles if not in the scrotum will lie in the inguinal canals, or still higher in the abdominal cavity. They may be functionally perfect. Their absence is due to an arrest of the descent of the testicles from the abdomen to the scrotum, which takes place normally in fetal life.

There are varying degrees of undescended testicle. If one testicle is found in the inguinal canal of an infant, but can be easily pressed out of the canal into the scrotum, the mother should be shown how to press it through the canal and lightly draw it down into the scrotum. If this performance is repeated every day one may safely trust to the growth of the parts to prevent the testicle from lodging permanently in the inguinal canal.

In some infants and even in some young boys the inguinal canal is so large that the testicle, although it lies in the scrotum most of the time, may be pushed up into the abdomen at will. The effect of gravity and motions of the body soon bring it back into the scrotum. If this condition is not associated with hernia it need cause no alarm, and the growth of the child may be safely trusted to bring about a normal state of affairs.

Treatment.—If the testicle is firmly fixed in the inguinal canal it will be exposed to injury by reason of its position, and it will not develop properly on account of the constant pressure exerted upon it. Attempts should therefore be made to bring it down into the scrotum, or at least to get it out of the inguinal canal and below the external ring. Gentle manipulation by the surgeon every two or three days should first be tried. If no progress is made the overlying parts should be incised and the testicle freed, all of the tissues of the cord except the vas and the vessels being divided. The testicle is brought down as far as the elasticity of the remaining portion of the cord will permit, and after a pouch has been prepared for it in the scrotum, it should be sutured to the subcutaneous tissue at the bottom of the scrotum by fine chromicized catgut. These sutures should of course be passed through the fibrous envelope of the organ and not deep into its substance. The inguinal canal should be strengthened by sutures if it is found weak or had to be split up to permit the drawing downward of the testicle. After a few weeks, when all inflammatory reaction has subsided, gentle manipulation and traction should again be resorted to. This will complete the cure in case it was not possible at the time of operation to bring the testicle well down into the scrotum.

If the testicle at operation cannot be brought out of the inguinal canal, or if it is located under the skin of the thigh or perineum, it is better to push it back into the abdomen and to close by suture the internal ring, so that the testicle shall not be constantly exposed to injury and pressure. Within the abdomen it can carry on its functions normally. For this reason no search should be made for a testicle which is situated above the internal ring.

If an undescended testicle is accompanied by hernia, an operation for radical cure of the hernia should be performed at the same time.

Some surgeons advocate the removal of an undescended testicle because of the fact that sarcoma sometimes develops in such an organ. This is a small risk, and removal should not therefore be made a routine treatment, if the testicle can be moved into a safe place.

CHAPTER X

AFFECTIONS OF THE FEMALE GENITO-URINARY ORGANS

INJURIES AND FOREIGN BODIES

Contusion.—Contusions of the external genitals are not uncommon either as the result of blows or falls, or in the case of young girls as the result of violent attempts at coitus. Bruises and abrasions and wounds should receive the same treatment given to these lesions in other parts of the body (pp. 2 and 13). Owing to the sensitiveness of the skin and its exposure to contamination from discharges, etc., especial efforts at cleanliness are recommended.

Rupture of the Hymen.—The hymen is frequently ruptured in early attempts at coitus, although usually the slight tear is not serious and requires no treatment. Sometimes the hemorrhage is great enough to alarm the patient and may even require ligature. Unless the tear extends beyond the limits of the hymen no suture should be inserted. Irrigation with hot saline solution after urination will add to the patient's comfort and lessen the risk of infection.

Rupture of the Vagina.—If the vagina is narrow and non-elastic, it too may be ruptured in violent coitus. Indeed the rupture may extend into the rectum. It may also be ruptured by a fall upon some sharp object.

The first step in treatment is a complete speculum examination, in order to determine the extent of the injury. If the breaks in the mucous membrane are slight it is better not to introduce a suture. The parts should be cleaned by irrigation with a hot mild antiseptic solution, and may be kept from adhering by a slender tamponade with aseptic gauze.

Hematoma.—A hematoma may be formed in the loose cellular tissue about the vaginal orifice. If small, it may be left to be absorbed, but if large or near the surface, a short incision should be made—one-half inch will usually suffice—and the blood clot should be evacuated. (See the treatment of hematoma given on p. 3.) The pressure of dry aseptic dressing will quickly cause the walls of the cavity to adhere. If there is any doubt of the asepsis a gutta-percha drain should be inserted. This should merely pass through the skin and not fill the cavity. After two days it should be removed, and not again inserted unless suppuration has taken place. If there is suppuration the cavity of the hematoma should be treated like that of an abscess, by free incision and light gauze drainage (p. 38).

Acute Laceration of the Perineum.—The perineum may be torn by external violence, but the almost invariable cause is childbirth. The tear is usually a straight one in the median line or near it, the variation in different cases being merely one of extent. Slight tears heal with sufficient exactness, even without sutures, but it is a good plan to suture every laceration, as otherwise some deeper ones are sure to be overlooked.

The portion of the perineum which tears is wedge-shaped, with the thin edge of the wedge forward. When torn, therefore, there are two surfaces for the insertion of sutures, namely, the vagina and the skin. The vaginal sutures are the more important, since they should protect the deeper part of the wound from the lochial discharge. The web between the thumb and fingers is similar to the perineum. If it is cut through there will be a palmar skin wound and a dorsal skin wound, corresponding to the vaginal and skin wounds in a perineal tear. Similarly, if the cut extend deeper, muscles will be divided. If one bears this analogy in mind in suturing a torn perineum he will have little difficulty in th correct apposition of the torn surfaces.

Treatment.—The proper treatment for laceration of th perineum is the immediate aseptic suture of the separated tis sues in their normal relation. This is very easy under favorabl conditions. If the patient weighs one hundred and eighty pound and lies in the middle of a low soft bed and no trained assistan is obtainable, the task is well-nigh impossible. The patient shoul lie on the back, with thighs well flexed and hip close to the ed of the bed and raised on a hard pillow. An anesthetic is a co venience, but is not absolutely necessary in many cases. T labia are drawn well apart, and the wounded surface wiped dry with a gauze sponge. Blood from the cervix or uterus can be prevented from flowing over the perineal wound by pushing one or two gauze sponges well up into the vagina. The extent of laceration can then be accurately seen.

If any muscles or the perineal body have been torn, deep as well as superficial sutures must be inserted. Plain catgut, No. 2, or ten day chromic catgut, No. 1, is a good material for the deep suture. It saves time to insert it as a continuous suture. The vaginal tear should then be sutured from its upper end downward. The same material may be used for suture. It is of the greatest importance that the upper end of the tear shall be accurately sutured. Otherwise fluid may trickle down into the wound and defeat union altogether or in part. The wound in the skin should be sutured with fine black silk; or if it is desired to insert these sutures more deeply, so that they shall aid in holding together the perineal body, silkworm gut is an excellent material.

If the tear extends into the rectum, the mucous membrane of the latter should be sutured with fine black silk, in addition to the muscular and cutaneous sutures mentioned above.

After-treatment consists in keeping the suture line as clean as possible. The patient may be catheterized; but if she passes water voluntarily, the line of sutures should be cleansed each time with sterile water, and carefully dried with sterile gauze. The patient should lie on her side and face a part of the time, and not continuously on her back. Non-absorbable sutures should be removed in ten days. For the late treatment of laceration of the perineum, see page 275.

Hemorrhage.—In the treatment of hemorrhage of the female genitals, it is all important to locate its source. It is necessary to insist upon this point, since a feeling of delicacy upon the part of the patient and physician as well, may result in the injudicious application of tampons or external compresses by the nurse or patient. The only rational procedure is a complete exposure of the parts in a good light, thorough cleanliness, and the ligation if necessary of bleeding vessels. Slight hemorrhage can be controlled by gauze compresses, applied either within or outside the vagina by the surgeon himself, under the favorable conditions mentioned above. If the patient is sensitive an anesthetic should be given. The introduction of gauze within the uterine cavity to control hemorrhage is a procedure rarely required and one worthy of the most careful antiseptic precautions and subsequent treatment in bed. The use of dilute solutions of suprarenal extract to control hemorrhage has been spoken of on page 6. Larger bleeding vessels should be ligated with fine catgut, and any wounds closed by sutures of catgut or fine silk.

Rape.—A physician is sometimes called upon to examine a woman or young girl in order to determine whether rape has been attempted. He ought to exercise great caution in making a positive affirmation, unless the laceration of the hymen and possibly of the vagina clearly show a violent distention of these parts. Purely external injuries may of course have been caused by other means. The microscopical demonstration of semen upon the clothes of the female is better evidence, but this is a subject for medico-legal experts. On the other hand, coitus, though forced, may leave no external evidence in case of an adult, so that a negative statement should not be carelessly made. The doctor ought rather to confine himself to a statement of the condition in which he finds the external and internal genital organs.

Also in the matter of a purulent vaginal discharge, which in young girls often excites suspicion that they have been improperly handled by some man, a physician should be careful not to claim too much. A purulent discharge of this character may or may not be due to gonococci, and, even if it is demonstrated to contain gonococci, it may have been set up by contact with some other female or by the use of a dirty towel, or in some other manner than by attempted coitus.

Foreign Bodies.—Foreign bodies are frequently introduced into the vagina and urethra for the sake of sexual excitement. The patient seldom loses control of such objects in the vagina, but those which are introduced into the urethra may slip from the fingers or be broken in the canal, and thus medical aid will have to be summoned. The greatest variety of objects have been found under such circumstances, either in the urethra or partially or wholly within the bladder. Slate-pencils, hairpins, and hatpins are among the commonest. The pins are introduced head foremost, so that their extraction is difficult. Foreign objects in the vagina are usually neglected pessaries, or some objects which have been introduced by the patient to prevent prolapse of the uterus.

The symptoms produced will depend upon the location and character of the foreign body. It may interfere with urination, or cause a bloody or purulent discharge, or set up inflammation of the urethra or bladder. If the foreign body remains a long time in the urethra or bladder, it may become the core about which a calculus is formed. If it is in the vagina it may also become incrusted, or it may partially bury itself in the vaginal walls.

Diagnosis.—The diagnosis of a foreign body is made partly from the symptoms above enumerated, but chiefly from the results of physical examination. Digital examination, direct inspection through a vaginal speculum, or through a smaller urethral speculum, called a urethroscope (Fig. 130), are the usual methods em-

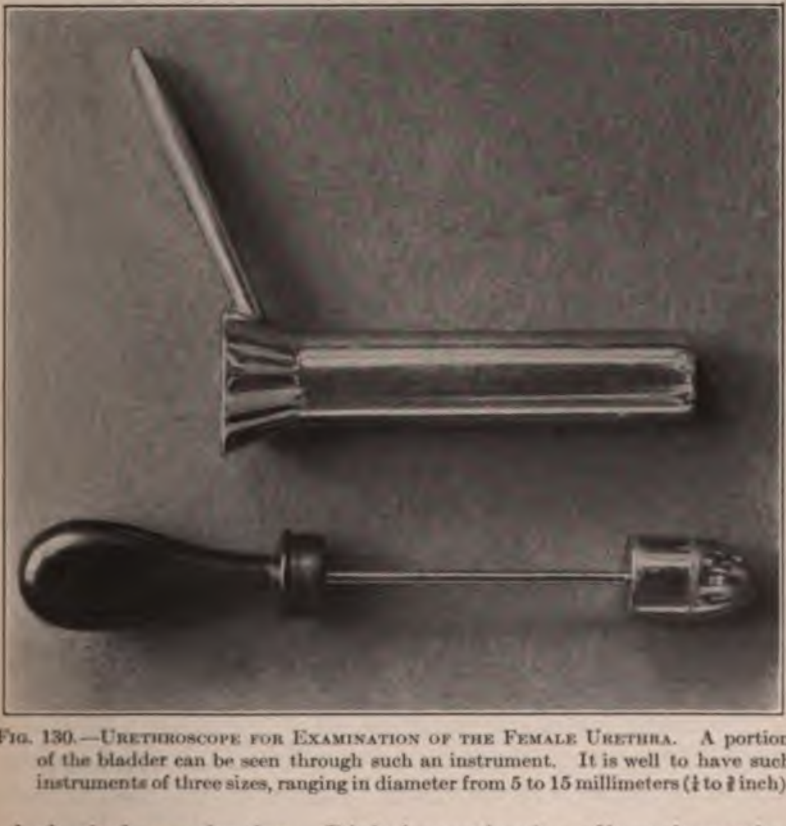

Fig. 130.—Urethroscope for Examination of the Female Urethra. A portion of the bladder can be seen through such an instrument. It is well to have such instruments of three sizes, ranging in diameter from 5 to 15 millimeters (⅕ to ⅗ inch).

ployed. When the foreign body is in the bladder, it usually lies transversely, especially when the bladder is empty, since the long axis of the collapsed organ is transverse. Its presence may be recognized by means of a sound or by the finger passed through the dilated urethra, or by the cystoscope.

Treatment.—The removal of these foreign objects affords a wide scope for the ingenuity of the surgeon. If the foreign body is in the vagina, this canal should be thoroughly cleansed by irrigation and sponging with an antiseptic solution, in order to reduce the risk of infection in wounds which may be made intentionally or accidentally in removing the foreign body. An old pessary can usually be extracted without difficulty, even if it is encrusted. Some objects are best removed after being cut into two or three pieces.

A blunt pointed object lying in the urethra may possibly be worked out of the canal, a little at a time, in the manner described in connection with foreign bodies in the male urethra (p. 207). If a pin lies in the urethral canal with the point directed outward, it may be possible to pass a small rubber tube into the urethra and over the point of the pin, so that the latter can then be crowded outward, or safely grasped with a slender pair of forceps and extracted. The adult female urethra is capable of dilatation sufficient to permit the passage of the little finger. This dilatation not only facilitates an exact diagnosis, but it is a material help in the extraction of foreign bodies by means of slender forceps. Small foreign bodies and calculi can be extracted whole. Larger calculi and friable objects may be crushed and extracted. If the foreign body cannot be moved through the moderately dilated urethra, it is better to perform suprapubic cystotomy than to run the risk of permanent incontinence by too great dilatation of the urethral canal.

INFLAMMATIONS

Pruritus. An intense itching of the vulva, most marked in the vicinity of the clitoris, and associated with a thickening of th skin is commonly called pruritus. Objection has been made t this word, since it expresses a symptom rather than a distinct disease, but it serves a useful purpose, and for the present at leas had better be retained.

Pruritus is due to a number of causes, such as an irritating vaginal discharge, or to decomposition of the urine in diabetes, or to parasites, such as pediculi or seat worms. In other cases it is due to the use of drugs, or to improper articles of diet. Sometimes no cause for the itching can be ascertained, and the pruritus is assumed to have a nervous origin. In severe cases the patients are most miserable, and scratch and tear the skin until it bleeds.

TREATMENT.—In every case the cause for the pruritus should, if possible, be discovered and removed; but even when this can be done, a certain amount of local treatment is necessary. The parts should be bathed twice a day with very hot water, or hot boracic acid solution. This should be followed by the application of a five per cent solution of carbolic acid, or a solution of corrosive sublimate, one grain in a half ounce each of alcohol and water. Tincture of iodine, or five per cent solution of creolin or of nitrate of silver, twenty grains to the ounce, have also been used with benefit. The folds of the vulva should be kept from contact by talcum powder or boracic acid or dermatol; or they may be separated by thin layers of gauze smeared with boracic acid ointment or an ointment containing menthol or chloral or cocain. Parasites should be destroyed by mercurial or sulphur ointments.

In obstinate cases success has sometimes followed resection of the sensory nerves which supply the clitoris and labia minora. In other cases portions of the labia and the clitoris have been removed.

Eczema.—Eczema of the vulva often follows vulvitis and pruritus. Its treatment is similar to that of eczema in other portions of the body (see p. 57).

Simple Vulvitis and Vaginitis.—The delicate skin about the entrance to the vagina and the vagina itself may become inflamed as a result of many causes. Such predisposing factors as poor health, exposure to cold and wet, and traumatism have to be considered, while more immediate causes are irritating urine, hemorrhagic and mucous discharges from the uterus or urethra, indiscreet coitus, constant rubbing to relieve pruritus, etc. Inflammation due to the gonococcus is considered on page 262.

The symptoms are those of inflammation everywhere, edema, redness, increased heat and tenderness, plus a mucopurulent or purulent discharge, which more or less mats together the folds of skin and the hairs. Urination is not usually attended with burning, unless gonorrhea exists.

TREATMENT.—It is desirable to know the cause of the inflammation, and in every case in which this is obscure, or in which the inflammation is severe, the discharge should be spread on a glass slide, dried and stained for gonococci. Even in the non-specific cases precautions should be taken to prevent the infection of other persons either by direct contact or by the use of towels, etc., which have been used by the patient.

Attention to the bowels, rest, and frequent bathing of the inflamed surfaces with a boracic acid solution or one of aluminum acetate, two per cent, will usually cure these patients in a few days if the cause of the inflammation is not a continuous one. The cleansing is best performed by irrigation both within and outside of the orifice of the vagina, and the solutions should be as hot as can be borne. In the case of little girls, in whom inflammations of this character are rather common, the irrigation should be made with the utmost gentleness, and care should be taken not to block the orifice in the hymen by the nozzle of the syringe. The folds of skin should be carefully dried and anointed with cold cream or boracic acid ointment to prevent chafing.

Acute Gonorrhea.—**Gonorrheal Vulvitis.**—The acute symptoms of a gonorrheal infection of the vulva are similar to those of a simple vulvitis excepting that they are more marked. There is more or less constant pain aggravated by walking, and as the urethra is generally involved, there is pain on micturition. The skin is reddened, possibly excoriated in places, and there is a profuse mucopurulent discharge. When this has been sponged away, it will be observed that the mucous membrane at the urethral orifice is red and swollen, and pressure of the finger upon the urethra will cause a drop of pus to exude. The orifices of Bartholin's ducts are often similarly affected, and the glands themselves may be swollen (see p. 263). The diagnosis of gonorrhea should always be confirmed by a microscopic examination of the discharge.

TREATMENT.—Gonorrheal inflammation of the vulva is of itself not serious, except in the case of young children. The risk of the infection depends chiefly on its possible spread to the bladder or to the uterus and Fallopian tubes, and through them to the pelvic peritoneum. The treatment recommended by different writers varies considerably. Some believe that such simple local treatment as a hot vaginal douche is capable of spreading the infection, and should not, therefore, be advised. The majority take the opposite view, and recommend a hot douche with a permanganate solution of the strength of one part of permanganate of potash to two thousand of water; or the use of vaginal tampons. One plan is to insert after the douche a tampon saturated with five per cent argyrol solution, and to remove this in ten minutes, and to follow it by a tampon saturated with boroglycerid or some other astringent, and to allow this to remain in place until the next treatment, twelve hours later. Whatever plan of treatment is followed, the patient should remain absolutely quiet in bed until the acute symptoms have passed over. The diet should be simple, large quantities of water or milk should be given daily, and urotropin or some other urinary antiseptic should be administered. (Compare the medication recommended on page 213.)

In the later stages of the disease with profuse leucorrheal discharge a douche of sulphate of zinc ʒj and powdered alum ʒij to 2 quarts of water is very effective.

Gonorrheal Urethritis.—Treatment for gonorrheal urethritis in women is similar to that employed for men. The solutions used for injection through a blunt pointed syringe may be somewhat stronger. When the general inflammation has subsided, local areas of persistent infection may be touched through an endoscope with a cotton swab wet with a solution of silver of a strength of ten per cent or less.

Inflammation of Bartholin's Gland.—On either side of the vaginal orifice is situated the gland named after its discoverer, Bartholin. This gland lies immediately under the skin, and is subject to infection through its short duct. The infection is usually of a gonorrheal origin. Swelling of the mucous membrane of the small duct prevents evacuation of the mucus and pus from the cavity of the gland.

Upon examination there will be found by the side of the vagina, just outside of the hymen or its remains, a smooth, rounded, slightly movable swelling, very tender on pressure, and giving an indistinct sense of fluctuation. If the inflammation is a violent one the surrounding cellulitis will obscure these signs, or if the suppuration has broken through the gland into the subcutaneous tissue there will be the usual signs of abscess.

TREATMENT.—The skin should be anesthetized and the abscess opened at the point where it lies nearest the surface. When its contents have been evacuated, a small triangular portion of the skin and subcutaneous tissue overlying the abscess should be cut away. This will greatly facilitate subsequent dressings, for if a simple straight incision be made it will be found difficult to reinsert the gauze necessary to keep open the incision until the cavity of the abscess has granulated from the bottom upward.

Simple Suppuration.—The usual forms of suppuration, boils, abscesses, and cellulitis, may occur in the skin of the external genitals. The treatment is similar to that outlined on page 34 et seq.

Chronic Gonorrhea.—When the acute symptoms due to gonorrhea have subsided the trouble may be found to have lodged in the bladder or cervix uteri. The chief symptoms of cystitis will be increased frequency and urgency of micturition, with a sense of discomfort and heaviness or well marked pain. The general health of the patient is a good deal affected by this constant irritation. Daily irrigations of the bladder with mild antiseptic solutions should be practised. Nitrate of silver is the favorite remedy for this purpose. The solution first used should not contain more than one part of this drug in four thousand of water, but this proportion may be increased as the patient becomes accustomed to the drug. Argyrol in solutions of two per cent or more makes another good fluid for irrigating the bladder.

If the gonorrheal process extends to the cervix and uterus, as shown by a persistent leucorrhea, the cervix should be dilated and the lining of cervix and uterus swabbed with cotton moistened with a ten or twenty per cent solution of argyrol every two or three days.

Endocervicitis: Erosion of the Cervix.— Inflammation of the cervix uteri may be due to congestion of the uterus caused by malposition, etc., or to laceration or to gonorrhea. There is usually an exposure and hypertrophy of the columnar epithelium, which gives the os a pouting or unnaturally raw red appearance; hence the term ulceration is often used, though incorrectly.

The most marked symptom of endocervicitis is an increased discharge of mucus from cervix and vagina (leucorrhea). Sometimes there is a thick yellowish plug of mucus hanging from the os at all times. This is said to be characteristic of gonorrhea, but the diagnosis should be made only after microscopic examination. Leucorrhea may be due to endometritis as well as endocervicitis. It is also found in women who have not borne children. It is the symptom of endocervicitis for which treatment is usually sought.

TREATMENT.—Whether there is a local cause for it or not, the state of the health has an important bearing upon the continuance of leucorrhea, just as it has upon catarrh of other mucous membranes, and the treatment of the patient should always include directions calculated to improve the general health. Local treatment consists in the use of hot vaginal douches once or twice a day. The fluid used for this irrigation may be pure water or a weak solution of carbolic acid (one teaspoonful to the quart) or any other antiseptic or astringent solution. To the astringent action of douches may be added that of drugs placed upon a cotton tampon and applied through a speculum directly to the cervix. Ichthyol, ten per cent in glycerin, tannic acid, and glycerin and iodine are favorite remedies. Applications of nitrate of silver, ten to twenty per cent, may be made to the cervical canal. If there is any malposition of the uterus or laceration of the cervix or any other condition which may tend to prolong the discharge, it should be made the object of special treatment, the details of which will be found in text-books on gynecology.

Gonorrheal endocervicitis is particularly difficult to cure. The canal may be touched with strong solutions of silver, or antiseptics and astringents may be introduced in the form of suppositories into the uterine cavity. Amputation of the cervix is frequently necessary to bring about a cure.

Endometritis.—There are various forms of endometritis, both acute and chronic, but the common form and the only one which will be considered here is the hyperplastic form, marked by chronic congestion with thickening of the mucous membrane which lines the uterus. It has various causes, among which constipation, stenosis of the cervix, uterine displacement and cervical laceration are the chief.

The symptoms are an abnormal discharge of blood either at the menstrual period or at other times, and a discharge of mucus—

leucorrhea, which for the most part is due to the accompanying endocervicitis.

Diagnosis is made from the symptoms, from bimanual examination, and from examination through a speculum. The uterus is enlarged and soft, and may be variously displaced. Mucus protrudes in many cases from the eroded cervix (see p. 264). Passage of a probe shows an elongation of the uterine canal, with a possible relaxation of the internal os.

TREATMENT.—Hot douches and tampons (see p. 265) may give temporary relief, but cannot effect a cure in most cases, since they do not remove the cause of the congestion. Constipation should be overcome, bad habits of life corrected, and an effort made to tone up the general system. Operative treatment consists in dilatation of the cervical canal and removal of the hypertrophied mucous membrane. Lacerations should be repaired and malpositions corrected.

Dilatation of the Cervical Canal.—Dilatation of the cervical canal is the most important of minor gynecological operations. This can be performed in many cases under a local anesthetic, but a general anesthetic is usually more satisfactory for both surgeon and patient.

Dilatation is performed for the relief of dysmenorrhea, to overcome sterility, and to permit of curettage or other operations within the cervix or uterus. The technique is as follows: The bowels should be thoroughly emptied the day previous by laxatives and an enema. The hair should be removed by shaving, or better, it should be clipped short by scissors, thus saving the patient from a good deal of discomfort when the shaved hairs begin to grow out. The external parts should be cleansed with soap and hot water, and the vagina douched with a five per cent solution of creolin or some other antiseptic. The patient is put in the lithotomy position, and the posterior wall of the vagina is depressed with a weighted speculum. The anterior lip of the cervix is seized with a tenaculum forceps and drawn down. If a local anesthetic is employed, three drops of two per cent solution of cocain should be injected into the tissue grasped by the forceps, and similar injections should be made into other portions of the cervix and up the cervical canal. An applicator wrapped with absorbent cotton saturated with a ten per cent solution of cocain should be passed into the cervical canal, and allowed to remain in place for at least ten minutes. It is necessary that the tip of the applicator pass the internal os, as otherwise the anesthesia will not be complete.

The direction of the cervical canal should next be determined by the uterine probe. The knowledge thus gained is of importance in inserting the dilator. The dilator should be fully introduced before its blades are opened. A little rotation in one direction or the other facilitates its introduction. Gentle pressure is then made upon the handles for ten seconds. The pressure is then relaxed, the dilator rotated for a sixth of the circle, pressure again exerted, and so on. In this manner, by brief periods of gentle pressure made in different directions, the cervix can be sufficiently dilated to permit the introduction of a curette or other instrument or the insertion of an intra-uterine stem pessary. The patient should remain in a recumbent position for at least twelve hours after this operation.

Curettage.—The inner lining of the uterus is frequently scraped out as a means of treatment in cases of endometritis, and also as a means of removing portions of placental tissue remaining after abortion, or as a means of obtaining tissue for a microscopical examination in cases of suspected cancer of the uterus, etc.

The cervical canal is first to be dilated. The extent and direction of the uterine cavity is then determined by the uterine probe, and its lining scraped from the fundus to the cervix by a sharp curette. This should be systematically done, as otherwise the scraping is apt to be excessive in certain portions and insufficient in others. The detached shreds of mucous membrane should be thoroughly washed out by means of a double current uterine catheter. The fluid used for irrigation should be hot to aid in controlling hemorrhage.

The patient should remain in bed for two days or more, according to the cause for which the curettage is performed. A custom which some operators have of packing the cavity of the uterus with gauze is not to be recommended in most cases.

If the scrapings from the uterus are of a fungoid or exuberant character, they should be examined microscopically, since they may be part of a malignant growth.

Chancroid.—A chancroid may occur anywhere about the vaginal orifice or its immediate vicinity. If it is so situated as to lie between two folds of skin, the lesion is often reproduced on the opposing surface. For this reason several chancroids of varying ages and sizes are often found in the same patient. The progress of the disease and the best method of overcoming it are described on page 222. It is desirable to keep apart, as far as possible, the folds of skin so as to limit the spread of the infection, hence the necessity of frequent dressings and thorough cleanliness. A fold of gauze laid between the labia of the right and left side, and held in place by the perineal strap of a T-bandage, will be found helpful.

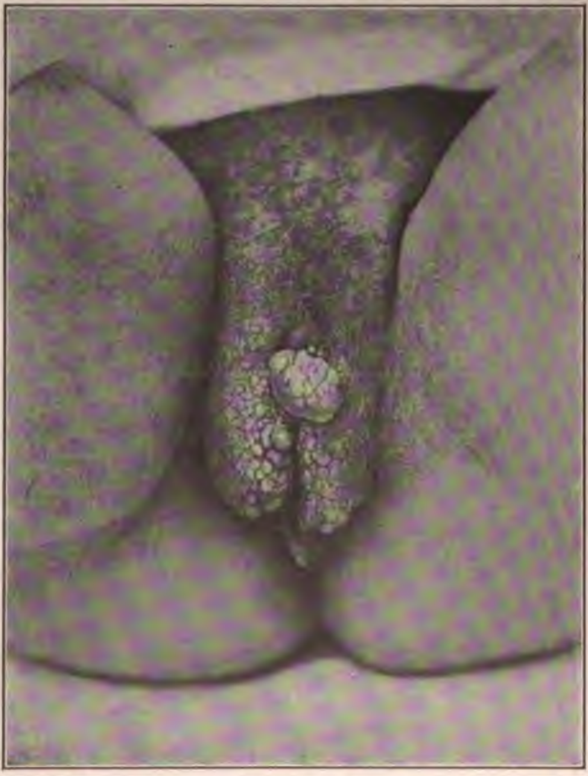

FIG. 131.—MULTIPLE SYPHILITIC TUMORS OF THE VULVA.

Syphilis.—A chancre, the primary lesion of syphilis, may occur at any exposed portion of the genital organs of the female, but is most likely to be found upon the labia minora or some other portion of the delicate skin about the vaginal orifice. It may be single, or two separate lesions may coexist.

The primary lesion of syphilis is apt to be overlooked in the female. The surface where it may occur is much greater than is that of the male, and is not so readily examined. Hence, a woman may contract syphilis without knowledge of the fact. This explains the occurrence of later lesions of the disease in women who deny that they have ever had syphilis, and whose truthfulness there is often no reason to doubt.

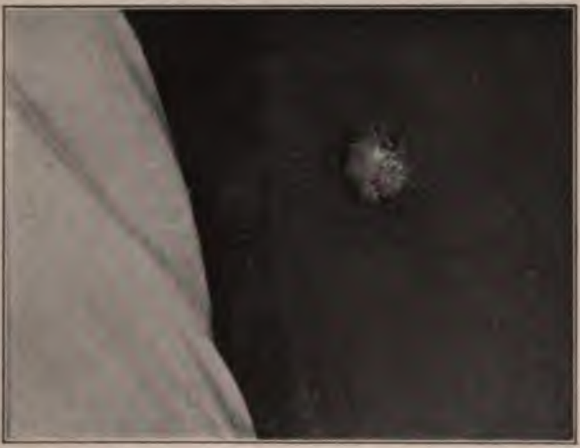

FIG. 132.—SYPHILITIC TUMOR OF THIGH NEAR THE VULVA. Patient a negress aged twenty-seven years.

The diagnosis is not difficult when a primary lesion is found. Its appearance is similar to that of a primary lesion upon the male genitals.

The later lesions of syphilis are not infrequently found upon the vulva. The tissues are prone to hypertrophy under the influence of prolonged irritation, so that mucous patches develop strongly and condylomata become extensive, later syphilides often assuming a multiple papillomatous character (Fig. 131). This is the more usual form, although single tumors also occur (Fig. 132), as well as gummatous ulceration.

For the local and constitutional treatment of syphilis, see page 61.

TUMORS

Benign Tumors.—The benign tumors of the external genitals, such as papilloma, lipoma, etc., require no especial description. The treatment is the same as when similar tumors are found elsewhere in the body (see p. 185).

Cyst of Bartholin's Gland.—The duct of Bartholin's gland may become obstructed, leading to a distention of the cavity of the gland with mucus. This gives a fluctuating, rounded tumor at one side of the vaginal orifice, covered by normal skin, and freely movable on the deeper parts. It should be dissected out through an anteroposterior incision and the wound closed by suture. Or it may be cut into at the site of the normal opening of the duct, and drained with a small wick of silk threads until the artificial canal thus formed has become lined with epithelium.

Suppuration of Bartholin's gland is described on page 283.

Urethral Caruncle.—This is a vascular tumor of the meatus, made up of connective tissue and hypertrophied papillæ and numerous dilated blood-vessels. It is covered with epithelium. Such a little tumor is often extremely sensitive, so that the passage of urine or the slightest touch will give the patient great pain.

The diagnosis is easily made if the labia are separated and the urethral orifice is inspected. There will then be noticed a bright red tumor, usually entirely outside of the urethra, but sometimes partly within it, springing from the mucous membrane by a slender pedicle. Sometimes more than one such tumor exists.

TREATMENT.—The caruncle should be thoroughly removed after anesthesia has been produced by cocain. On account of the delicacy of the overlying epithelium, the application of a bit of absorbent cotton saturated with a ten per cent solution of cocain will produce a complete anesthesia in a few minutes. The mucous membrane should then be divided around the pedicle, dissected back for a short distance, so that the base of the tumor may be divided below the level of the surrounding mucous membrane. The vessels should be ligated with fine catgut and the cuff of mucous membrane sutured with fine black silk so as completely to cover the raw area. The stitches should be removed in four days.

Polyp of the Cervix.—A polyp of the cervix is a more or less rounded tumor composed of the same tissues as the mucous membrane from which it springs. It is usually distinctly pedicled. It generally springs from the mucous membrane of the cervical canal, and gives rise to more or less hemorrhage and pain. As soon as it appears in the external os the cause of the hemorrhage is evident. Before such appearance the diagnosis is extremely difficult.

Treatment.—The pedicle of a polyp may be seized with forceps and twisted off. If the point from which the polyp springs is not distinctly visible, the cervical canal should first be dilated. On account of the possibility that polypoid degeneration of the cervical mucous membrane may be the initial stage of cancer the operation should be a more thorough one in patients who have passed their fortieth year. A general anesthetic should then be given, the cervix fully dilated (p. 266) and the base of each polyp, or the mucous membrane from which the polyps spring, should be resected. In every case the excised tissue should be examined microscopically.

Carcinoma.—Carcinoma of the vulva begins in a hard swelling which soon ulcerates, infiltrates, and affects the inguinal lymphatic glands. In other words, its characteristics are those of cancer in other portions of the body. Owing to the abundant blood-supply of the parts its growth is rapid. Carcinoma of the vagina as a primary lesion is seldom seen.

Carcinoma of the cervix is very common and may be recognized both by palpation and inspection as an indurated swelling, with rough surface, ulcerating, and having a putrid odor. There are, however, some cases of erosion of the cervix, due primarily to laceration and secondarily to inflammatory discharges from the uterus, which do not present the ordinary appearances of cancer, but which upon microscopical examination may prove to be malignant. In suspicious conditions of this kind it is important to remove a section of the ulcer for examination by a competent pathologist. This can be easily done through a bivalve or tubular speculum, the pain being prevented by the injection of a few drops of a two per cent cocain solution.

Treatment.—A malignant tumor, whether beginning externally or internally, should be thoroughly removed if possible. If this is not possible, it had better be left alone. Those who advocate a partial removal for the sake of getting rid of foul discharges apparently forget that ulcers will soon form again, and that t patient will, sooner or later, be subjected to the annoyance of ulcerating cancer, unless perchance she succumbs to the so-call palliative operation.

No mention is made of benign tumors of the body of t uterus, or other abdominal tumors, since the consideration of su lesion is wholly out of the range of minor surgery.

ACQUIRED DEFORMITIES

Relaxation of the Sphincter of the Bladder.—Inco nence of Urine.—Incontinence of urine is an affection of old whose treatment is most unsatisfactory. With advancing years sphincter of the bladder becomes relaxed until a woman find impossible to hold her water as long as she has been accuston to do. If the relaxation of the sphincter is slight, incontine will only take place when the patient coughs or otherwise sudde increases the pressure upon the bladder. In more marked deg of the trouble there is a constant dripping of the urine, wh keeps the patient in a distressing condition not only for hers but for those about her. This weakness is often increased b local condition of cystocele or prolapse of the uterus. The p bility of an overfilled and overflowing bladder should be born mind, though this condition is less common in women than in n

Before condemning a patient to the constant use of a rul urinal the urine should be drawn by catheter and carefully ex ined so that its amount and character may be known. One sh not forget the possible presence within the bladder or urethr a calculus or other foreign body, or a polyp or other tumor, w may be the cause of the incontinence. Attempts should be n to stimulate the sphincter by massage, by astringent applicat applied in the urethra or vaginally, by cold bathing, and by tricity. If the urine is found to be neutral or alkaline, ben acid may be given, or the benzoate of soda ten grains a day. T drugs are [illegible] and should therefore be g [illegible] More often the urine is sc [illegible] drinking-water and alk [illegible] cystocele or prolapse of the ure [illegible] by a pessary or cured by operatio

Incontinence of Childhood.—Incontinence of urine by night or by day is not uncommonly seen in both male and female children, but is more troublesome in girls than boys (see p. 220). The attention of the parents should be directed to the general conditions which favor this affection, and they should see that the child sleeps under light clothing and drinks plenty of water in the forenoon and but little or nothing for some hours before going to bed. It is often of advantage to arrange the mattress so that the hips are slightly higher than the shoulders. Cold sponge baths night and morning are also of assistance in overcoming the trouble. In no case should a child be punished for a weakness it cannot avoid and which mortifies it extremely. Among the various drugs which have been tried with more or less success belladonna has attained quite a reputation, and its use is sometimes followed by marked improvement. The urine should always be examined, and if it is unduly acid, alkaline diluents should be given. In obstinate cases the occasional passage of a cold steel sound into the bladder will stimulate and strengthen the sphincter so as to increase its control. Another good plan is to give the child a measuring-glass, and encourage it to retain its water for a time after the first inclination to urinate is noticed. Such restraint should not be carried too far, the idea being a gradual strengthening of the muscles through systematic exercise. One can safely predict that the lack of control will disappear before the age of puberty is reached.

Retention of Urine. — CATHETERIZATION. — Retention of urine in the female is rarely seen except after an operation or after childbearing. It is due sometimes to the anesthetic, sometimes to the changed abdominal pressure, sometimes to the operative wound in the immediate vicinity, and sometimes simply to the horizontal position. There are women who are unable to pass water lying down, even in health.

The risk of catheterization is a slight one, but it should be avoided when possible. It is better, therefore, to postpone it until the patient has made some ineffectual attempts to empty the bladder and feels pressure. This will usually mean the lapse of twelve or sixteen hours after an operation or delivery. After many gynecological operations the nature of the operation makes it undesirable to allow the patient to urinate. In such cases the bladder should be emptied regularly by catheter, without waiting for the patient's sensations.

Catheterization, which is so simple to one accustomed to its performance, may be very embarrassing to the beginner, especially if the nurse announces that she is unable to find the urethra. It is therefore worth description.

The old practise of passing a catheter by touch has no place in modern aseptic technique. The operator should sterilize his hands or wear sterile gloves, although if he proceeds properly and a glass catheter is used this is not strictly necessary, for he will not touch any part of the catheter which enters the urethra. The patient flexes the thighs and separates the knees widely. If she is lying on a soft bed, a pillow should be placed under the hips to raise the vulva well above the level of the bed. With the thumb and fingers of one hand the operator separates the anterior part of the labia minora widely, so as to expose the vestibule. With the other hand he wipes the vestibule clean, using a swab of absorbent cotton wet with a mild antiseptic. He next drops the swab, and with the same hand takes the sterile catheter, near its outer end, and passes it gently into the meatus. The catheter should be wet with saline solution. No other lubricant is needed, unless the catheter is unduly large. It will readily follow the urethra to the bladder, and the urine at once streams out. When the bladder is empty, the forefinger is placed over the end of the catheter in order to prevent the escape of the urine as it is withdrawn. If a rubber catheter is used, some lubricant is generally necessary, and this fact, together with the necessity of grasping the catheter near the tip, makes it desirable that the hands of the operator shall be sterile. The irritation which follows the repeated use of a glass catheter is probably due to the fact that it is too large, or is taken from an irritating solution before insertion, or that it is not introduced with sufficient gentleness.

Prolapse of Urethra.—The female urethra may prolapse from the meatus and cause much discomfort, or even sharp pain. The prolapse may be complete, that is, affecting the whole surface of the mucous membrane, or partial, only one side of the urethra being affected. Astringents will relieve symptoms in mild cases. In severer cases cauterization, both by heat and by chemicals, is often tried, but usually proves unsatisfactory. It is better to excise the protruding membrane and to make an exact suture of the cut edges, using a sharply curved needle and fine black silk. If the prolapse is extensive the whole circle of mucous membrane must be removed and the wound closed with exactness. The best method of suturing is by a number of interrupted fine black silk stitches. The stitches should be removed in four or five days. This operation may be performed under cocain, applied on a cotton swab directly to the mucous membrane. A four per cent solution should be used for the purpose. If it is found necessary to inject cocain, the area of mucous membrane to be removed should be marked out with a scalpel before the injection is made. Otherwise the swelling caused by the injection may easily mislead the operator as to the amount of tissue which it is necessary to excise.

Another method of operating upon prolapse of the urethra is to make an incision through the mucous membrane of the vagina a little way above the orifice, and to draw out through this incision so much of the urethral mucous membrane as is considered to be superfluous. This is cut away and the wounds in urethra and vagina are sutured separately, the former at least with absorbable sutures.

Old Laceration of the Perineum.—The operation to restore the perineum after an old laceration rests on the same principles as that to close a fresh wound in the perineum. The surface of the cicatrized area must, however, be dissected away before the sutures are inserted, and either removed entirely or left to project as a fold into the vagina. These operations require a general anesthetic and a treatment in bed of not less than ten days or two weeks in order to secure a perfect result. Their details are given in every gynecological text-book. An operation to restore the perineal body is strongly to be advised as a preventive of future prolapse, even though the patient has no present symptoms.

Prolapse of Uterus.—The uterus may sink so low down as to present itself partially or wholly outside the vaginal orifice. This condition is known as prolapse of the uterus and is usually found in women who have borne several children. For the occurrence of a prolapse three things are necessary: a torn perineum, greatly relaxed vaginal walls, and a lengthening of the ligaments which normally hold the uterus in position. In addition, the whole uterus, or at least its cervix, is usually elongated and heavier than normal.

A uterus which protrudes partly or wholly from the vagina causes the patient discomfort, prevents her from walking easily, and often makes it impossible for her to retain urine for more than an hour or two during the day. Moreover the cervical mucous membrane being unaccustomed to such exposure, often ulcerates, so that a foul discharge may be added to the other discomforts of the sufferer.

TREATMENT.—In simple cases if the outlet of the vagina is not too much widened, a retroversion pessary (Fig. 133) may cure the patient of all symptoms. In many cases, however, the pessary will gradually work out of the vagina as the patient walks about. Special supports have been devised, but the pressure which they make upon the cervix is often painful and may cause ulceration. The usual form of apparatus consists of a belt to which is attached posteriorly a spring. The spring passes between the legs of the patient and curves upward into the vagina. At its extremity is a ball or else a little cup which fits over the cervix. Such apparatus is cumbersome, hard to keep clean, and should not be advised whenever an operation is possible. A T-bandage will sometimes give temporary relief if the uterus is crowded well

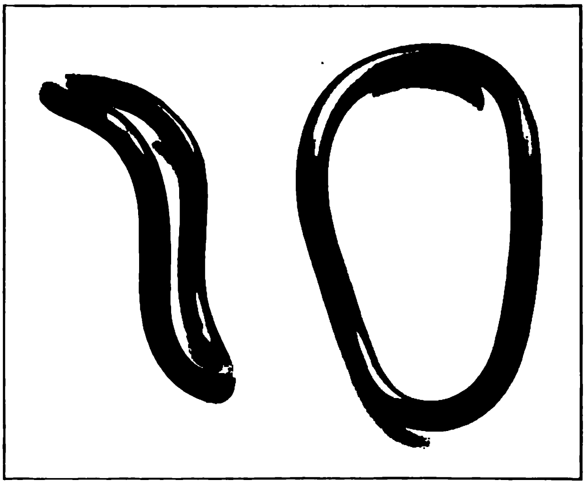

FIG. 133. RETROVERSION PESSARY WHICH IN MANY CASES WILL KEEP WITHIN THE VAGINA AN OTHERWISE PROLAPSED UTERUS.

upward by several large cotton tampons pushed into the vagina before the perineal strap of the bandage is secured.

Several operations have been advised for prolapse of the uterus. The perineum may be restored by suture. The caliber of the vagina may be reduced by partial excision and suture of its walls. A hypertrophied cervix may be amputated, the round ligaments may be shortened, the uterus may be suspended by suture to the abdominal wall, or finally a complete hysterectomy may be performed. This last operation, while entailing a somewhat greater risk than the others, has the great merit of not being followed by recurrence.

Fistula of the Vagina, etc.—Fistulæ between the ureters and vagina, or bladder and vagina, or urethra and vagina, or vagina and rectum may be due to necrosis of the septa between these various tubes, brought about by long continued pressure in childbirth, or as the result of an accident, or as the result of inflammation, or they may be due to malignant ulceration.

The existence of a fistula is made known by the passage of gas or fecal matter from the rectum into the vagina or bladder; or of urine into the vagina or rectum. Sometimes a probe can be passed through the fistula or digital examination may demonstrate its presence.

Fistula from a benign cause may be cured by a plastic operation, many ingenious forms of which have been devised. Success is most likely to follow an operation in which the defects in the two mucous surfaces are closed in such a manner that the suture line in one organ is not exactly opposite the suture line in the other. Of course no attempt should be made to close a fistula due to malignant ulceration unless the tumor has first been wholly removed.

CONGENITAL DEFORMITIES

Adhesions of the Clitoris.—Adhesions of the prepuce to the clitoris may wall in sebaceous material, and give rise to irritation which in turn may induce habits of masturbation. This condition should therefore be sought for in cases of unexplained reflex irritation. The clitoris is exposed by drawing outward and upward the upper ends of the labia minora, at the same time pushing the fingers backward against the symphysis, in order to make the head of the clitoris project forward. The technic is similar to that performed to uncover the head of the penis of a fat squirming baby. If adhesions are present, this manipulation will make them appear.

TREATMENT.—The parts should be saturated with twenty per cent cocain solution for ten minutes. The prepuce can then be withdrawn without pain, and while tension is made upon it, a small flat probe should be passed around the head of the clitoris to break up all adhesions. The raw surfaces should be smeared with cold cream. The parts should be washed daily with warm water, and this retraction and anointing should be repeated every second day for a week or two to prevent the reformation of adhesions. If there is a redundancy of prepuce, it may be excised and the wound sutured with fine black silk. This is a material aid in breaking up the habit of masturbation, as the practise is interrupted for a few days by the soreness and the changed sensation assists the child in not resuming the habit.

Imperforate Hymen. —The hymen may be without an opening. As a result of this malformation, when menstruation first occurs, the escape of blood from the vagina may be prevented. Such a patient will have the usual subjective symptoms of menstruation without any flow of blood. Under these circumstances a careful examination will reveal a cystic distention of the hymen, and the dark blue color of the concealed fluid will at once explain matters. An incision should be made and the blood and blood clots allowed to escape.

In other cases the lack of development may extend higher up and the vagina be partly or wholly absent or the cervix be without an opening.

Stenosis of the Cervix.—An imperfect development of the cervical canal is one of the commonest causes of dysmenorrhea. The opening may be so small that it will only admit the passage of a small probe. This may be sufficient for the escape of fluid blood, but not for the easy passage of even a small blood clot. The result is a contraction of the uterus, continued until the cervix is sufficiently dilated to permit the clot to escape. The pain thus caused may be very severe, even causing unconsciousness. The stenosis may disappear with repeated menstruation or with the sexual stimulus of marriage, but such is not always the case. It is permanently overcome in most cases by pregnancy.

Treatment.—It is surprising how many young women are allowed to suffer unnecessary pain during the first day or two of menstruation year after year, when a slight operation and a little subsequent treatment would avoid it. The indication under such circumstances for dilatation of the cervical canal is clear enough. The technic of its performance is given on page 266. In these cases it should not be followed by curettage, as the uterine mucous membrane is in no wise at fault. When the cervix has been dilated, a hard rubber plug (Fig. 134) should be inserted and left in place for two or three months. This should be about 22 or 25 French catheter scale, and should be long enough to reach through the internal os, as otherwise it may slip out of place. These plugs are sometimes made with a lateral groove to permit the escape of blood during menstruation. This is unnecessary, as the blood escapes around the plug and the groove makes a lodging-place for blood and mucus. If symptoms of obstruction recur in a few months after the removal of the plug, it should be reinserted.

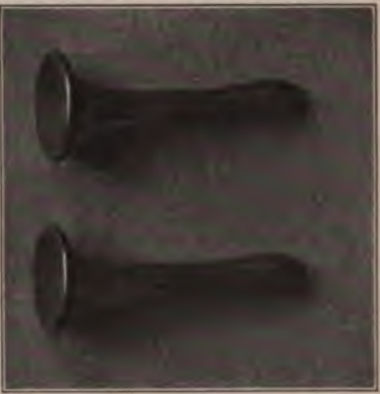

Fig. 134.—Hard Rubber Plugs for the Cure of Stenosis of the Cervix.

This operation can be painlessly performed with cocain; but in many cases the sensibilities of the patient render a general anesthetic desirable.

A hard rubber plug of this shape acts as a valve and will prevent the entrance of seminal fluid into the uterus. The dilatation of the cervical canal which follows its use is favorable to pregnancy after the plug has been removed.

SECTION V

AFFECTIONS OF THE ANUS AND RECTUM

CHAPTER XI

INJURIES AND INFLAMMATIONS OF THE ANUS AND RECTUM

METHODS OF EXAMINATION

Examination of the Patient.—There are two positions of the patient which are satisfactory for an office examination of the anus and lower portion of the rectum. If the patient is a man he may stand with his back toward the light and bend well forward, resting his hands upon the seat of a chair. This position affords the examiner an excellent view of the region of the anus, and it also facilitates digital examination, especially of the anterior portion of the rectum.

The other position, which is to be employed with women, and which is preferred by some surgeons in all cases, is the lateral recumbent position, with both thighs flexed upon the abdomen. The thigh which is uppermost should be flexed a little farther than the other.

Examination begins with inspection not merely of the skin, but also of the anal canal. The folds of the anus should be separated and the anal mucous membrane should be drawn out a little at a time, and the patient should also be directed to strain, so that the examiner may see how much venous dilatation is thereby produced.

Palpation is chiefly of service to reveal the extent of inflammatory exudation, and to show the existence of a hidden fistula.

If a sinus exists, the passage of a probe will sometimes reveal its direction and extent. This is usually a painful method of examination, and the knowledge thereby gained is not always very extensive.

Digital examination is of the greatest importance. A rubber glove may be worn or the finger may be covered with a finger cot. The latter is thinner than a glove, and so does not dull the sensation to the same degree, but it does not protect the base of the finger from contamination. Even by the thinnest finger cot the tactile sense is somewhat obscured, as any one may prove for himself by making tests upon various rough objects.

The finger should be well oiled, preferably with a heavy lubricant, such as vaseline, or one of the preparations from Irish moss. It should be inserted slowly and rotated during the insertion, in order to clear the folds of mucous membrane. When the finger has been fully inserted, all of the rectum within reach should be systematically palpated with the palmar surface of the finger. It is possible to recognize in this way a wound, impaction of feces, a foreign body, a fissure, an abscess, a fistula, inflammatory thickening of the rectal wall, a stricture, a benign or malignant tumor, or a hemorrhoid.

One can usually obtain far more knowledge from a digital examination made when the rectum is empty; but since it may be desirable to know what is the usual condition of the rectum, it is just as well to make an examination when the patient first presents himself, and if the rectum is found to be full of feces, the bowel should be thoroughly emptied by a cathartic or enema, and a second examination made.

There is one other position in which a patient should sometimes be examined: namely, a squatting position. In this position, and especially if the patient strains, the examiner's finger will reach portions of the rectum which are inaccessible in other positions. Furthermore, if the normal planes of tissue have been in any way weakened, this fact will be manifest in this position as in no other. This is equally true of excessive valvular formation within the rectum, and of hernial protrusions outside of it.

Inspection of the interior of the rectum by means of a proctoscope will often yield valuable knowledge without an anesthetic. The instrument used should be short, not more than three or four inches in length, and preferably an inch or more in diameter (Fig. 135). If a tube of much smaller caliber is employed, the mucous membrane will lie in such deep folds that a great deal of it will escape observation. If the hips are higher than the abdomen, and the clothing is all loosened, the intestines will fall away from the pelvis, and the lower portions of the rectum will gape open and fill with air. This facilitates very much the inspection through the proctoscope. The knee-chest position is especially good for this purpose. In many patients, even though no inflammation be present, the passage of the proctoscope excites a painful spasm of the sphincter ani. This method of examination is not suited to cases in which acute inflammation is present.

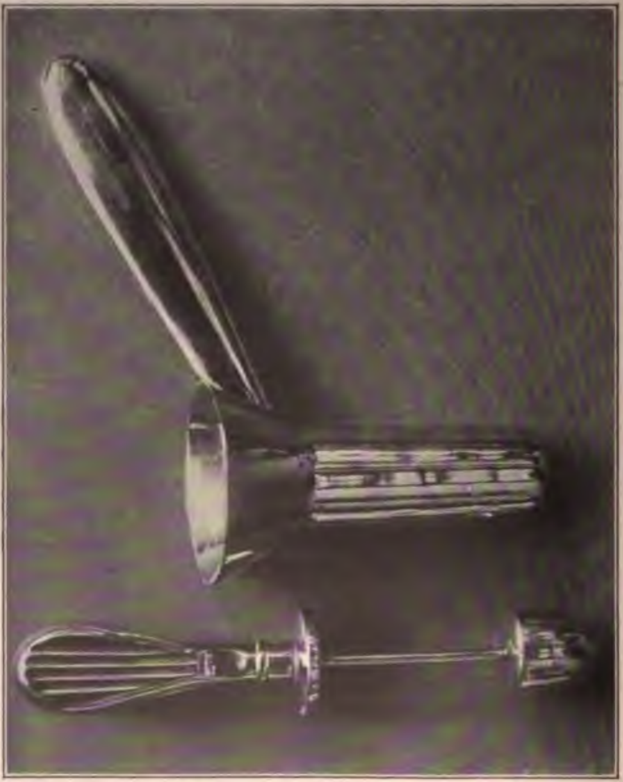

FIG. 135.—A SUITABLE RECTAL SPECULUM FOR OFFICE EXAMINATIONS.

Stretching of the Sphincter Ani.—It may be necessary to stretch the sphincter ani for purposes of examination, or as a means of treatment, or as a preliminary to treatment. It is best performed in the following manner: The patient should be thoroughly anesthetized with gas, ether, or chloroform, and should be in either the dorsal position, the legs being held by a crutch or an assistant; or else he should lie in the lateral position, with the knees well drawn up toward the chest. The anal region should be cleansed with soap and warm water. The two forefingers of the operator should be lubricated and pushed well up into the rectum. Their palmar surfaces should be directed away from each other. Steady pressure should next be made to separate the two fingers, and this pressure should be exerted in different directions antero-posteriorly, laterally, and obliquely. As the sphincter gives way, a third finger should be inserted, and then a fourth. The sphincter cannot be considered dilated unless the two fingers of each hand may be pressed against the ischia on either side without the use of much force. Some operators prefer to stretch the sphincter with the thumbs. Digital dilatation in the manner described is safer and otherwise more satisfactory than dilatation by means of any instrument. The mucous membrane at the anal margin will usually be cracked here and there, but these superficial breaks in the mucous membrane require no treatment other than that of cleanliness. The patient may get up and go about as soon as the dizziness caused by the anesthetic has passed off.

Stretching of the sphincter often causes some hemorrhage in the deep tissues, so that on the following day the anus may be surrounded by a black and blue zone. This will disappear without treatment in a few days.

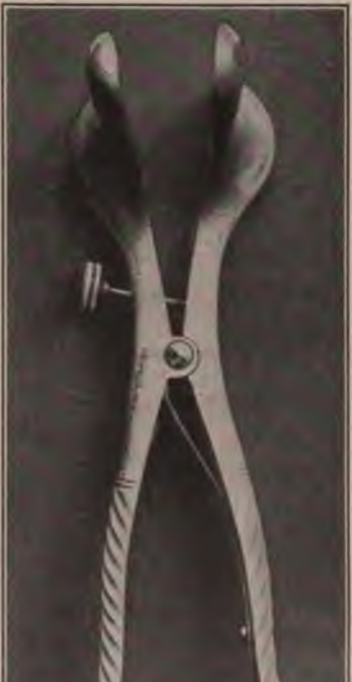

FIG. 136.—BIVALVE RECTAL SPECULUM. A good instrument to employ after the sphincter has been stretched.

Stretching the sphincter greatly facilitates inspection of the rectum through a speculum. A bivalve instrument (Fig. 136) can then be employed and turned in different directions, so as to give a view of the whole canal.

INJURIES

Wounds of the anal region are for the most part due to falls upon sharp objects; or they may be the result of violence inflicted by the patient or others. Slight wounds may follow the passage through the anal canal of some sharp object, such as a splinter or fish bone which projects from a fecal mass. In making the examination of a patient who has fallen upon a sharp object it is well to remember that a small foreign body may pass the anus and penetrate the wall of the rectum without leaving any external sign of injury; hence the importance of a speculum examination in such cases.

TREATMENT.—The first indication for treatment is the control of hemorrhage. External hemorrhage will be noticed at once, and may be controlled by pressure or styptics, such as adrenalin or peroxid of hydrogen. If a vessel is lacerated above the sphincter, hemorrhage may take place into the rectum and not make itself manifest for some time. Under such circumstances the passage of a speculum or of a rectal catheter or any other tube will show at once whether the bleeding is continuous. If so, the sphincter should be dilated and the ruptured artery ligated.

If the wound is so placed as to be pulled upon by the dilation and contraction of the sphincter, which takes place during defecation, it is better to stretch the sphincter fully, so as to insure rest to the wound. This not only adds to the patient's comfort, but hastens repair.

Wounds in this vicinity should be treated like all other wounds by thorough cleansing, and if of sufficient size, by a careful suture. Although exposed to contamination, wounds of this region heal promptly in many cases, thanks to the free blood-supply. Fine black silk is the best suture material to employ for the portion of the wound which is external. The portion of the wound which is so situated that the stitches cannot be easily removed should be sutured with plain catgut or a fine ten day chromicized gut. If the wall of the rectum is wounded, the possibility of peritoneal involvement should be borne in mind.

Hemorrhage.—Hemorrhage into the rectum or from the anus may be due to a gross injury or to a small ulceration occurring in connection with hemorrhoids, prolapse, or tumors. Furthermore, the hemorrhage following operation upon the rectum, while not strictly speaking within the domain of minor surgery, often shows itself after the operator is out of reach, and its treatment should therefore be understood by every practitioner.

TREATMENT.—As stated above, bleeding from an external wound or ulcer is readily controlled by pressure, ligation, or styptics, such as peroxid of hydrogen or adrenalin. If there is capillary oozing, as from a prolapsed hemorrhoid, the applications of swabs wrung out of very hot water will usually control it.

Hemorrhage from a vessel so far up that it is not included in the sphincter ani is far more dangerous, and demands prompt and thorough treatment. When this follows operation within a few hours it either comes from a vessel which has not been ligated or from which the ligature has slipped. The usual symptoms are these: The patient will complain of some pain in the rectum, and state that he feels that his bowels are going to move. The nurse or doctor will probably tell him that he is mistaken, and that his feelings are due to the operation or to the presence of gauze in the rectum, if a plug of this material has been inserted. In a few minutes the patient will again insist that his bowels are going to move, and the passage of four or more ounces of fluid blood will prove the correctness of his statement. Under such circumstances any gauze should be removed from the rectum, the bowel irrigated with as hot a sterile saline solution as the patient can bear, and if the flow of blood continues, an anesthetic should be given, the sphincter dilated, a bivalve speculum inserted, and the bleeding point exposed and ligated.

This accident is peculiarly liable to follow operations upon internal hemorrhoids, performed under cocain, with incomplete or no dilatation of the sphincter. The cocain, or mixture of cocain and adrenalin deceives the operator in regard to the amount of bleeding possible from the cut surface, and when the astringent action of these drugs passes off the real mischief begins.

There is also the so called secondary hemorrhage, due to the opening of an artery by the sloughing away of the ligature which has been put around it. This is most likely to follow when masses of other tissue are included with the artery in the ligature, a method of technic advised by some operators upon hemorrhoids. Such secondary hemorrhage may therefore occur five or seven or even ten days after the operation. Its symptoms and treatment are the same as those given above.

Foreign Bodies and Impacted Feces.—Foreign bodies are frequently inserted into the rectum, either for the purpose of sexual excitement or to assist in defecation or in urination. Insane persons sometimes pass foreign bodies into the rectum. The rectum, especially in old people, is tolerant of foreign bodies, owing no doubt to the fact that in civilized life many persons habitually allow fecal matter to remain in the rectum for hours or possibly for days. Such hardened balls of feces may become so firm that they cannot be evacuated and require the treatment of foreign bodies.

TREATMENT.—The extraction of a foreign body is a simple process after the sphincter has been dilated (p. 282). Smaller objects may be extracted with the finger or a dressing forceps guided by the finger. In this way the patient may be saved the annoyance of a general anesthetic. A hardened ball of feces can usually be broken up digitally and extracted piecemeal by the finger or by dressing forceps or washed out by repeated injections, after it has been broken up. The rectum should have rest for a few days to recover its tone and to allow for healing of the abrasions which may be produced. Hot external applications are grateful to the patient.

INFLAMMATIONS

Intertrigo.—Intertrigo, or chafing of the skin, may occur on any portion of the body where two skin surfaces come into contact. It is especially troublesome between the folds of the buttocks. It may be due to a lack of cleanliness, to irritating discharges, or to an unusual amount of exercise. When due to the last named cause, it may be so severe that blisters develop. When due to irritating discharges, if it is long continued it may pass into eczema.

The essentials of treatment are cleanliness, separation of the folds of the skin by gauze or cotton saturated with a cooling lotion, or the reduction of friction between opposing surfaces by means of a simple ointment, such as cold cream or a dusting powder. If unusual exercise is to be taken, the chafing can be prevented in many instances by a preliminary application of cold cream to the opposed surfaces.

Pruritus Ani.—This name is given to the troublesome itching about the anus which may occur at any age, but is especially common among elderly persons. In children it is often due to pinworms. In adults it may be caused by an irritating discharge from the rectum or vagina, or it may be due to hemorrhoids or to fissures. In every case the affected part should be examined in a good light. The folds of the anus should be separated in order to expose hidden fissures. If nothing is found externally a speculum should be passed, and the mucous membrane of the rectum examined. Digital examination should also be made, in order to determine the presence of hemorrhoids and the amount of contraction of the sphincter. The stools should also be examined, since they may be of an irritating character.

TREATMENT.—If any cause for the pruritus is found, it should be removed. If there are pinworms, a pint of water containing an ounce of the fluid extract of quassia should be injected into the rectum, and kept there fifteen minutes. In a child a less quantity will suffice. This treatment should be repeated on two or three succeeding days. If a fissure or hemorrhoid or ulcer of the rectum or other obvious cause of pruritus exists, suitable treatment should be instituted.

In all cases errors in diet should be avoided. The patient should give up alcohol, tobacco, and coffee. Constipation should be corrected. The rectum should be regularly emptied, and kept empty, by saline laxatives or enemata. If the sphincter is tight, it should be stretched. This may be performed by the doctor's fingers, the patient having been rendered unconscious by laughing gas; or a gradual dilatation may be preferred. The latter is best performed by the patient, who every night upon retiring should insert a hard rubber rectal dilator, and leave it in place for fifteen to thirty minutes. These dilators come in three sizes. After a few nights the patient will be able to pass the largest size without pain. When the dilator has been removed, the patient should liberally apply the following ointment:

℞ Camphoræ	gr. 4;
Menthol	gr. 3;
Ac. carbol.	gr. 30;
Ac. boric	gr. 10;
Calomel	gr. 10;
Ung. zinc. ox. q. s. ad.	oz. 1.

M.

This treatment should be continued every night for a month, or until the sphincter is looser than normal.

Some patients are relieved by the application of hot or cold water two or three times a day. This may be followed by an application of a powder composed of one part each of camphor and chloral rubbed together and added to thirty parts of starch.

The itching may be stopped temporarily by the application of a solution containing ten per cent or less of resorcin; or of one containing five per cent or less of carbolic acid. Another method of using carbolic acid is to apply it pure, and wash it off almost immediately with alcohol. This will sometimes stop the itching for several days. The surface may be painted with a mixture of equal parts of the tincture of iodine and the fluid extract of hamamelis.

If the skin is excoriated or inflamed by reason of scratching, it is a good plan to keep a fold of gauze between the nates, wet with some cooling lotion or smeared with vaseline containing 20 grains of carbolic acid and 10 grains of cocain to the ounce.

Proctitis.—Inflammation of the rectum, or proctitis, may be either acute or chronic, and the latter is again divided into atrophic and hypertrophic proctitis.

The acute form of the disease may be due to mechanical injury or to a sudden change in temperature, as when a person after exercise sits upon cold, damp ground; or to chemical irritation following the ingestion of improper food or to intestinal fermentation or to bacterial infection, either from the feces or from objects introduced into the rectum.

The symptoms of heat, fulness, and pain are common to catarrhal inflammation of all mucous membranes, and in addition there is a constant or oft repeated desire for evacuation. Usually the movements are fluid or mixed with mucus and blood.

Treatment.—The bowels should be irrigated for cleansing purposes, and this should be followed by a continuous irrigation for ten or fifteen minutes, with either hot or cold normal saline solution. This may be carried out through a specially devised double current rectal tube, or, as is more comfortable to many patients, two small soft rubber catheters may be employed, one for the inflow and one for the outflow. After the irrigation, a suppository of opium and iodoform should be inserted, or one containing iodoform and tannic acid, for in these cases opium and morphine must be used with caution. At least twice a day the saline irrigation should be followed by a stimulating enema. Various solutions have been recommended for this purpose, such as nitrate of silver, 1: 3,000; boric acid, 3 per cent; acetate of lead, 1: 500; fluid extract of hydrastis an ounce in two quarts of hot water, etc.

In chronic proctitis similar measures are to be employed. Usually the cause is a long continued one, and it may not be possible to remove it entirely. At least one may attend to the diet and keep the stools soft with castor oil or one of the milder salines. The astringent enemas may be somewhat stronger than in acute proctitis, but it is better to begin with the milder solutions and to increase their strength gradually as the effect is evident. Persistent ulcers may be sprayed or swabbed with still stronger applications.

Fissure.—Fissure of the anus is a crack in the mucous membrane at the orifice of the anal canal, and situated generally near the anterior or posterior commissure. It is due, in most cases at least, to the scratching of the mucous membrane by the passage of hard fecal masses and infection of the small wound. The especial development of the sinuses of Morgagni near the commissures is thought to determine the frequent development of fissures in these situations.

In its early stages a fissure gives the patient only a little discomfort. There is a stinging pain as the fecal mass passes the fissure, and a drop or two of blood may be found either on the expelled feces or on the paper used to cleanse the anus. There is also a feeling of heat or a throbbing dull pain for a few minutes. As the fissure becomes deeper and more indurated these slight symptoms are greatly increased. In an extreme case the thought of defecation fills the patient with terror, and the entrance of the fecal mass into the anal canal excites a violent spasm of the sphincter, which makes the act of defecation tenfold more difficult. The pain thus caused may last for hours and seriously interfere with the patient's daily life.

TREATMENT.—The treatment of fissure that can be carried out by the patient is most important, since under its influence many fissures of slight degree will permanently heal. The bowels should be made regular and the stools semisolid by changes in diet and such laxatives as are found to agree best with the particular patient. Straining at stool is to be avoided. Lubrication of the anal canal before defecation will do much to prevent the formation of a fissure and to favor the healing of one already existing. The patient can accomplish this by injecting a small syringeful of oil or by passing his greased finger into the anus. After defecation the anus should be washed, not rubbed with a dry and perhaps stiff paper. If the patient will not take this trouble he can at least expectorate upon the paper before applying it. The alkaline viscid saliva is non-irritating to the mucous membrane.

If the pain is marked, the patient should lie down for a half-hour after defecation, holding a hot water bottle or a hot wet sponge firmly against the anus.

By the measures above mentioned patients will succeed in curing many small fissures and in preventing many more. In severer cases these home remedies must be supplemented by treatment by the physician. Two plans have been found reliable, namely, treatment of the wound by antiseptics and stimulating applications and stretching or division of the sphincter ani.

If applications are decided upon, the fissure should be cleansed daily. This is best accomplished through a small conical speculum with a window in one side. Only mild antiseptic solutions should be employed, such as bichlorid of mercury, 1: 10,000; boric acid, 2 per cent; or peroxid of hydrogen, 1 part to water 8 parts. When the fissure is clean and dry it should be painted with the stimulating liquid. Balsam of Peru (40 per cent in oil); ichthyol, 20 per cent in water; silver nitrate, 2 to 5 per cent; argyrol or one of the other newer silver preparations in 16 to 20 per cent solutions are all good remedies.

By far the best treatment in many cases is the stretching of the sphincter ani under a general anesthetic (p. 282). This at once stops all spasm of the sphincter, does away with most of the pain during and after defecation, frees the fissure from injurious contact with the fecal mass in its passage, and without other treatment in many cases will effect a rapid cure.

During the stretching the fissure will probably be cracked open, but if care is taken not to make the pull all the while in one direction, the deepening of the fissure will not be serious. In fact, this very tearing open of the fissure itself has been said to be one of the chief elements in the rapid healing which follows stretching of the sphincter. This probably is not so; at any rate there are sufficient other grounds on which to explain the good results of this method of treatment.

There is still another method of treatment which has its advocates, and that is division of the external sphincter through the fissure. If the fissure should happen to be exactly in the anterior or posterior commissure, the incision may be made to one or both sides of it. While this method of treatment is unquestionably followed by a cure, it is difficult to see why one should enlarge the existing wound or add two fresh wounds, when the relaxation of the sphincter can be equally obtained by digital dilatation.

Abscess.—An abscess in the vicinity of the anus or rectum is generally called an ischiorectal abscess. Strictly speaking, many of the abscesses found in this vicinity are not situated in the ischiorectal space. The term is, however, so well established that it will probably remain in use, at any rate for the deeper abscesses of the vicinity.

It is well to recognize at least four types of abscess in this vicinity: (1) A cutaneous furuncle or boil; (2) an abscess beneath the skin at the margin of the anus, sometimes called a marginal abscess; (3) an abscess within the wall of the rectum, sometimes called an intramural or submucous abscess; and (4) an abscess outside of the rectum, which may be designated a perirectal or ischiorectal abscess. A still further differentiation is made by rectal specialists, but this classification is sufficient for practical purposes.

The source of infection in many abscesses can be determined. Thus it is evident that a furuncle starts around the root of a hair or from some abrasion in the skin. In marginal abscess and in a submucous abscess the infection enters through a fissure or some other break of the overlying skin or mucous membrane. Many ischiorectal abscesses have their origin in some wound or ulcer of the rectum; others are extensions of one of the three simpler types of abscesses mentioned. In still other cases no entering point for the infection can be discovered, and the determination of the site of the abscess seems to follow a bruise, or unwonted exercise, or sitting on damp ground, etc.

In the majority of superficial and deep abscesses of the anal region the pus contains bacilli coli or streptococci or staphylococci or tubercle bacilli. This is their order of frequency according to Gant.

The symptoms are those of abscess everywhere. If the abscess is small and superficial (Fig. 137), it will not give much pain except during defecation or when pressed upon. In other cases the pain is constant and intense. The deeper abscesses are usually situated either in the right or left ischiorectal fossa. Occasionally they extend across the posterior commissure; rarely across the anterior. Left to themselves, most of the abscesses tend to "point" through the skin or into the rectum (Fig. 138); others burrow upward into the pelvis, and thereby add to the

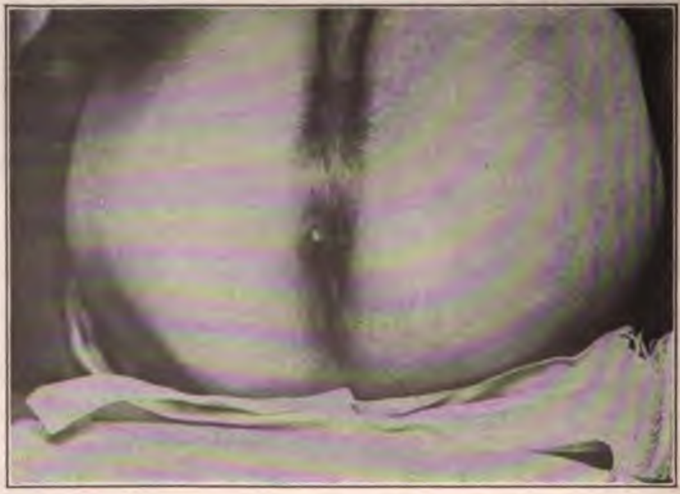

FIG. 137.—SMALL SUPERFICIAL ISCHIORECTAL ABSCESS. Duration one week. Patient aged thirty years.

gravity of the situation. When the abscess bursts, either through the skin or into the rectum, there is a sudden discharge of pus, and an equally sudden relief of symptoms. Such a rupture usually drains the abscess very imperfectly, so that there will be a more or less constant flow of pus, with partial subsidence of the induration, and a fistula which opens either into the rectum or through the skin, or in both directions, as the case may be (see p. 295).

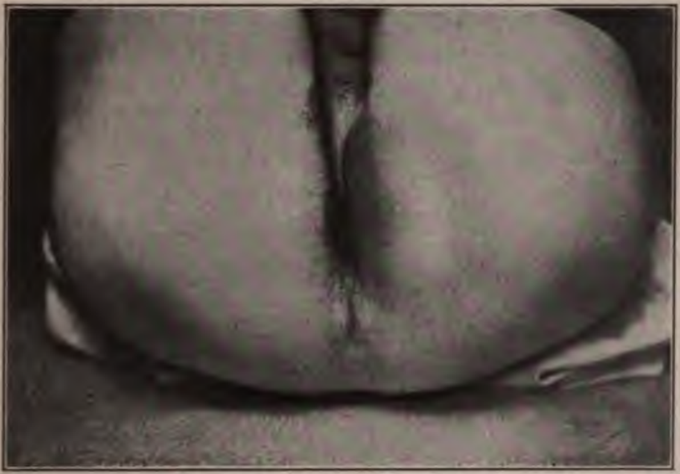

FIG. 138.—A LARGER AND DEEPER ISCHIORECTAL ABSCESS. Duration three weeks Patient aged twenty-two years.

TREATMENT.—Treatment of an abscess of any one of the four forms mentioned should be surgical; that is, the abscess should be opened with sufficient freedom to permit the easy escape of the pus, and the incision should be maintained by a drain or otherwise until the abscess cavity heals by granulation. A submucous abscess should be incised longitudinally; a marginal one, radially. All other abscesses of this region should be opened by an incision which is parallel to the fibers of the sphincter muscles. Such an incision will correspond more or less perfectly to an arc of a circle drawn around the anus.

While a small abscess may be opened without much pain to the patient by first freezing the skin and then injecting cocain, a general anesthetic is advisable for three reasons: It saves the patient from any pain; it enables the operator to explore more fully the deeper portions of the abscess, if such exist; and it permits him to stretch the sphincter. This will enable the operator to determine whether the abscess communicates with or closely approaches to the rectum, and it also makes subsequent defecation much easier, and thus hastens the patient's recovery.

The steps of the operation are these: The patient is anesthetized and placed either on his back, with his thighs well flexed, or else upon the affected side. In the latter case the upper thigh should be flexed more than the lower. A preliminary cleansing of the lower bowel and rectum by cathartics and enema is painful and may be omitted. The external parts are cleansed, the sphincter ani is dilated to a certain extent, the rectum is emptied by irrigation, and the abscess cavity is incised either radially or circumferentially, according to the principles stated above. The edges of the wound are retracted, and its cavity is irrigated with hot saline solution, and explored with the finger or a blunt pointed probe. Two points should be determined, whether the pus has burrowed in any direction, so that an extension of the incision is necessary, and secondly, whether the abscess cavity communicates with the rectum. To determine the latter, one finger is inserted in the rectum while a probe is passed into the different portions of the abscess cavity. If the probe touches the finger, or comes so close to it that only mucous membrane intervenes, all of the tissue between the finger and the probe should be divided by a radial incision (see the treatment of fistula, p. 297).

The cavity of the abscess should be irrigated with saline and drained with gauze. It should not be curetted, since the removal of the necrotic lining of the cavity in this manner will simply destroy the adjacent cellular tissue; nor should septa be broken down unless they are so placed as to interfere with drainage. They almost invariably represent blood-vessels which have been able to maintain their vitality in spite of the infection around them, and they will prove of assistance in the repair of the wound. The gauze used for drainage may be impregnated with iodoform or creolin or nosophen or covered with glutol. The cavity should not be packed; only sufficient gauze should be used to keep the walls apart.

If the abscess is small, so that the incision is short, it is well to remove from the center of the incision on one side a triangular piece of skin. This will facilitate drainage and keep the cut edges of the skin from uniting before the abscess cavity has time to fill with granulations.

Moist dressings should be employed, at least until granulation is well established. The outer dressing should be changed as often as it becomes soiled; the gauze drainage in the wound should not be changed for the first three or four days. After the first week the wound may be drained with gauze soaked with balsam of Peru, as this does not readily adhere to the wound, and dry gauze may be used externally. In many cases it is not necessary for the patient to remain in bed.

If the wound does not heal completely within a reasonable time, it is probably either tuberculous or communicates with the rectum. The latter point may usually be determined by the probe. The former may be inferred from the sluggish appearance of the sinus and from the amount of induration around it, and from the existence of tuberculosis elsewhere in the body. It can be definitely determined by the microscopical examination of a portion of the wall of the sinus removed under cocain.

If an ischiorectal abscess is known to be tuberculous at the time of operation the treatment should be more radical than that outlined above. The abscess cavity should be incised, irrigated, and explored as there stated. The edges of the wound should be fully retracted, and all infiltrated tissue dissected away with scalpel or scissors. The life of the patient may depend upon the thoroughness with which this is done. Bleeding points should then be secured, and the wound drained and dressed as stated above. An exception should be made in case the person has incurable tuberculosis in the lungs or elsewhere. Under such circumstances the operation should be limited to simple drainage.

Fistula.—The ordinary fistula in ano is simply a partially healed abscess, the complete healing of which does not take place, either because drainage is imperfect, or because fecal matter and gas enter the fistula from the rectum, or because the fistula is surrounded by an inflammatory process (tuberculosis, syphilis, etc.) which the body cannot overcome (Fig. 139).

For practical purposes fistulæ about the anus are of four kinds: either blind external or blind internal or complete, having both an internal and an external opening or complex. The first three terms are sufficiently descriptive. Under the last we shall here include not merely fistulæ with more than one branch, but those with openings into the vulva, vagina, urethra, or bladder, as well as fistulæ due to disease of bone.

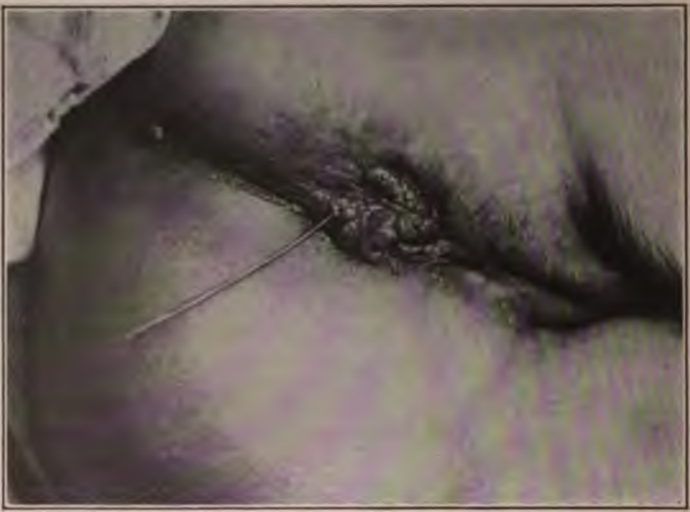

FIG. 139.—FISTULA ACCOMPANYING A SYPHILITIC STRICTURE OF THE RECTUM. Female patient, aged forty-four years.

DIAGNOSIS.—The symptoms of fistula are: The discharge more or less constantly of a small quantity of mucus, mixed possibly with blood or fecal matter; more or less swelling, induration, and tenderness, symptoms which are more marked when the fistula has no external opening, or, having one, drains imperfectly. The diagnosis is usually made by the patient before he seeks medical advice.

Examination will show the external opening, if one exists. It is usually surrounded by a slight elevation of the skin or mucous membrane, although it is sometimes hidden in a fold, and is sometimes temporarily covered with intact epithelium. Palpation with the finger-tips will show the presence of induration, whether the fistula opens externally or not. The indurated tissue may or may not be tender. Examination with a probe should be conducted with great gentleness, and if found painful should be at once discontinued, since the information obtained in this manner has only a slight value. In some cases the fistula leads so directly to the rectum that a probe can be passed, and its point felt by the inserted finger.

If a fistula is submucous or subcutaneous only, its external opening is near the anus. If the external opening is farther away, the fistula probably leads to the rectum, either through the sphincters or above them.

TREATMENT.—A patient may obtain relief from the pain of a fistula by the repeated use of a hot sitz bath.

There are three methods of treating fistula which are likely to effect a cure within a short time, and are therefore worth consideration. They are incision, excision, and excision with suture. The first is the method usually employed.

The preparation of the patient for operation is important. In this as in all other rectal diseases in which a few days' delay in operation is not prejudicial, the bowels should be emptied with great thoroughness. This requires at least three days, as no cathartics should be given within twenty-four hours of the time set for operation, and no enema should be given within twelve hours of that time. If the preliminary treatment is thoroughly carried out, and a small dose of morphine is given four or six hours before operation, the patient will come to the operating-table with a dry and empty rectum, and there will be no evacuation during the operation to infect the operative wound. On the other hand, if cathartics are given the day before operation, and an enema an hour or so before operation, the wound is almost certain to be soiled with fluid feces, and the chance of primary union is greatly decreased.

If the fistula is blind externally, the overlying tissue is split up by an incision more or less parallel to the sphincter ani, and the fistulous tract is curetted or cauterized. If scar tissue is abundant, or if tuberculosis is suspected, the tissue bordering on the fistula should be dissected away. The wound may then be sutured in whole or in part.

If the fistula is a blind internal one, similar principles should govern the operator. The sphincter must be fully dilated, the lining of the rectum carefully examined by means of a speculum, and any openings explored in various directions, with a bent probe. All fistulæ should be laid wide open. If a blind internal fistula extends nearly to the skin, an external opening should be made, and the case treated like one of complete fistula.

The usual fistula in ano is a complete fistula, having an opening into the bowel and one through the skin. The fistula itself may lie beneath the mucous membrane and the skin, or it may pass through the sphincter muscle, or between the external and internal sphincter, or above them both. When the sphincter has been fully dilated, a probe, or better still, a grooved director, is passed through the fistula into the bowel, and all the tissues lying upon it are then divided. The division of the sphincter should be strictly a radial one. Many fistulæ pursue an oblique course; hence, besides the direct cut through the sphincter it may be necessary to make an oblique incision in the skin, or one parallel to the fibers of the sphincter. It is possible in many cases to excise the the fistulous tract, suture the wound, and obtain primary union. The possibility of hidden suppuration should be borne in mind, and if the temperature rises, or tenderness or swelling increase after operation, the wound should be promptly reopened and drained.

Complex fistulæ that are of the same nature as the fistulæ already described should be similarly treated. Each branch should be thoroughly laid open or injected with a solution of nitrate of silver, 960 grains to the ounce. Fistulæ connecting with other hollow organs in the vicinity present such technicalities in their treatment that they will not be considered here. Fistulæ due to diseased bone will heal as soon as the focus of disease has been obliterated. Fistulæ between the anus and coccyx may be of congenital origin (see p. 181).

If the fistula is tuberculous or syphilitic, suitable constitutional treatment of the patient should be instituted. Tuberculous fistulæ can be healed even though there are other foci in the body, but their rate of healing is slow, and subsequent operations may be necessary.

Gauze drainage is satisfactory after incision or excision of a fistula. The bowels should be moved by the third day, and daily thereafter by mild laxatives. After each movement the wound should be irrigated with hot saline solution.

Gonorrhea.—Gonorrhea is occasionally found in the rectum, either as a result of an extension of the process from the vagina or by direct infection from a penis introduced into the rectum. The symptoms are those of a severe proctitis, namely, burning, a feeling of weight, pain in the rectum and back, greatly increased by defecation, and more or less tenesmus. There is a mucous or purulent or bloody discharge. If the person has been subject to unnatural coitus, the anus will probably be relaxed, and the swollen mucous membrane may pout from the orifice. Often there are erosions or fissures due to the irritating discharge. Frequently the patient will deny the possibility of direct infection. The demonstration of the gonococci in a smear made from the discharge is the best proof of the gonorrheal character of the inflammation.

Treatment.—Pain can be somewhat relieved by a hot sitz bath or by hot applications applied moist and covered with oiled silk, and kept hot by a hot bottle or brick (p. 127). But if pain is severe morphine must be given in a suppository or hypodermically. The rectum should be irrigated twice daily with hot saline, followed by a 2 per cent boric acid solution, or one of silver nitrate, 1:3,000, or protargol, 1 per cent, or permanganate of potash, 1:4,000, or even weaker. Other antiseptics suitable for injection are mentioned on pages 213 and 263. If the sphincter is tight, it should be stretched. This will often relieve the patient of a good deal of the pain both during defecation and at other times. Care must be exercised not to make deep tears in the infiltrated mucous membrane.

Chancroid.—Chancroids about the anus or in the anal canal may be reimplantations from chancroids of the genitals, or they may be due to direct infection from another person. They are far commoner in women than in men. The sores are usually multiple. In character they are similar to chancroids of the genitals.

In some cases there are few symptoms, and the disease runs a favorable course. In others the ulcers are phagedenic in character, or so situated that defecation is very painful. The inguinal glands are not infrequently swollen and may suppurate.

Treatment.—Most chancroids run a more or less definite course to recovery, but much can be done to prevent further infection of the surrounding skin. The parts should be bathed twice or three times a day with mild antiseptics, in order to remove and neutralize the discharge. The individual ulcers may be touched with stronger liquids, such as peroxid of hydrogen or carbolic acid solution, 5 per cent, or with pure ichthyol. Some writers recommend cauterization with the Paquelin cautery or with strong acids. If the spasm of the sphincter causes pain, it should be stretched, but with great gentleness, as extensive inflammation and death has followed this procedure in cases of chancroids. In all cases the folds of the nates should be kept from contact by a double layer of gauze or a thin piece of cotton wrung out of an antiseptic solution.

Syphilis.—Chancre, the primary lesion of syphilis, is not often seen in the anal region. When it does occur, it causes little pain and heals promptly, so that Tuttle suggests that the rarity of its observation may be the explanation of the numerous cases of syphilis seen for the first time in the secondary stage and without any history of a primary sore. Mucous patches may develop about the anus and undergo hypertrophy, so that their surface presents something of the appearance of cauliflower. They have

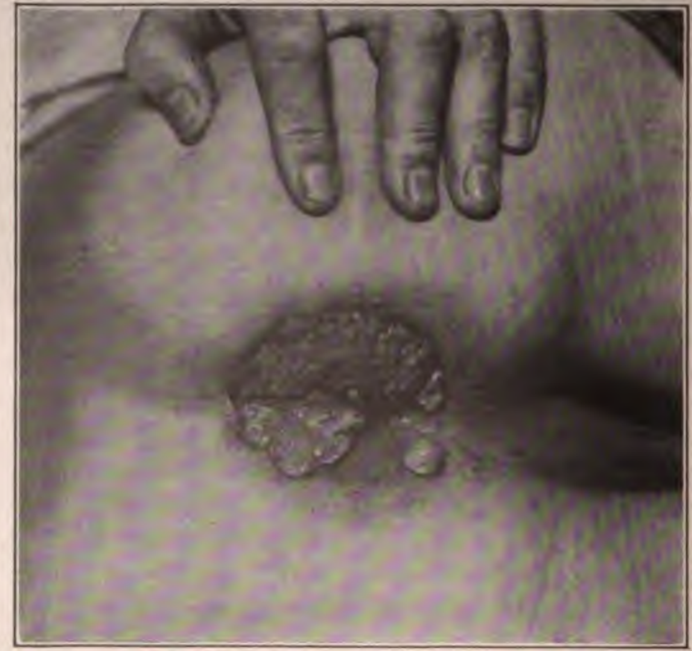

FIG. 140.—SYPHILITIC CONDYLOMATA ABOUT ANUS OF THREE WEEKS' DURATION. Patient a male aged sixteen.

received the name of condylomata lata (Fig. 140). The lesions are apt to be transplanted from one fold of skin to another.

TREATMENT.—The treatment is that of syphilis in general (see p. 61). Local treatment consists in cleanliness and protection of the sore and surrounding skin by dusting the former with calomel or oxid of zinc, or a mixture of the two, and keeping a fold of gauze between the nates.

Ulcerating lesions should be cleansed with an antiseptic solution and dried and dusted with any simple powder, or kept covered with moist gauze. The use of blue ointment upon every syphilitic sore is a disgusting practise which happily is going out of fashion. Tests show that ulcers do not heal as rapidly under it as when dressed with red wash or some other solution, provided the general treatment of the patient is the same.

Late Syphilitic Lesions.—Tertiary lesions, both gumma and diffuse syphilitic endarteritis occur in the rectum. They produce tedious ulcers, as is mentioned below, and are also of importance because they may be followed by stricture (q. v. p. 304).

Tuberculosis.—The anal region may be the seat of tuberculosis in the form of ulceration, either primary or resulting from a tuberculous fistula. In the former case the ulceration is shallow, but may spread over a wide area. In the latter case it may burrow deeply into the perirectal spaces. The rectum may also be the seat of tuberculous ulceration, usually secondary to tuberculosis of the lungs.

TREATMENT.—In these conditions the general treatment is all-important. Unless the resisting power of the individual can be raised, local treatment, such as curettage or cauterization, or even excision of the diseased tissues, is almost certain to be followed by a recurrence, or rather extension, of the process. Hence it is better to confine the local treatment to mild measures, such as daily cleansing with peroxid of hydrogen solution, one part of peroxid to eight of water, and the application of gauze saturated with balsam of Peru, or a solution of methyl blue, ten grains to the ounce. For the treatment of tuberculous fistula see page 297.

Ulcer of the Rectum.—Ulcer of the rectum may be due to traumatism, such as abrasion of the mucous membrane by hard fecal masses in a person whose vitality is at a low point; or it may be due to the intensity of an inflammatory process, either simple or venereal; or it may be due to tuberculosis, or to syphilis, or to a malignant growth.

Diagnosis.—The symptoms of ulcer of the rectum are pain, diarrhea, the discharge of mucus, pus, or blood, excoriation of the skin around the anus, tenesmus, spasm of the sphincter muscle, or possibly relaxation of the same if the ulcer is of long standing. These are general symptoms, some of which will be present in every case of ulcer, no matter what its cause.

The pain varies greatly. It is a prominent symptom in those cases in which the ulcer is situated low down, so that it is grasped by the sphincter.

Diarrhea is a prominent symptom in most cases. During the night, when the patient is in a recumbent position, there may be no stools. On rising he may have two or three in quick succession. The diarrhea is often accompanied with tenesmus. The doctor should never be satisfied to accept as satisfactory the patient's diagnosis of chronic diarrhea without assignable cause. In many of these cases an ulcer of the rectum exists, of which the diarrhea is the chief or only symptom.

The diagnosis can be made from the symptoms, but should never be considered complete until the mucous membrane of the rectum has been inspected through the proctoscope. For this purpose three or four tubes, of varying sizes and lengths, each fitted with an obturator, are necessary. The patient, with the clothes about the abdomen fully loosened, is placed in the knee-chest position, and as large a tube as the anus will admit is passed in as far as it will go readily. This is usually a distance of four to six inches. The obturator is then withdrawn, and light reflected from a head mirror is thrown into the rectum. As the tube is slowly withdrawn the mucous membrane of the rectum appears, inch by inch, at its inner orifice. In this manner most of the mucous membrane of the rectum can be inspected, provided a tube having a caliber of at least an inch can be used. It is important that the rectum shall be empty. In many cases, when the obturator is withdrawn, air will pass into the rectum and separate its walls to a certain extent. This facilitates examination, and under such circumstances a tube not more than three inches long may suffice for the inspection of the rectum for twice that distance.

If the anus will admit only a small tube, or if the insertion of any tube causes much pain, it is better to give an anesthetic, moderately dilate the sphincter, and insert a full sized tube. Special proctoscopes are made with glass obturators so as to permit the forcible distention of the rectum by air pumped into it.

Treatment.—If spasm of the sphincter exists, or if there is great pain on defecation, the sphincter should be moderately dilated. The patient should take as much rest in bed as he can afford. The feces should be kept, if possible, in a semisolid condition, as they then cause the least amount of irritation. The rectum should be irrigated at least once a day with a warm normal saline solution. The surface of the ulcer should be painted or sprayed with stimulating solutions, such as nitrate of silver, 1 per cent, zinc sulphate, 2 per cent, protargol, 5 per cent, argonin, 10 per cent, etc. If a stronger caustic is indicated, a solution of chlorid of zinc, 10 or 20 per cent, may be used. A bit of cotton is saturated with it and held in contact with the ulcer for some minutes. Another plan of treatment is to apply the remedy chosen in the form of a suppository or in the form of an ointment injected through a special ointment syringe.

In all cases of ulceration in which the deeper tissues of the rectum have been involved the possibility of resulting stricture should be borne in mind. During the later healing of the ulcer, and for some weeks after it has entirely healed, well lubricated flexible bougies should be passed at least once a week in order to prevent the formation of a stricture. This treatment should always be carried out with gentleness; otherwise the induration and scar formation will be increased by it (p. 306).

As the vitality of most patients who suffer from ulcer of the rectum is below normal, suitable tonic treatment should always be carried out. This is especially true in case of tuberculous ulceration, and will do far more toward effecting a cure of the ulcer than any number of scrapings or excisions of diseased tissue.

In syphilitic ulceration antisyphilitic treatment is the curative treatment, but it should be combined with the local treatment above indicated. The frequency of stricture in these patients seems to be due in great measure to the neglect of treatment during the active stage of the ulceration.

The ulceration of malignant disease is an unimportant complication, which of itself does not require other than cleansing treatment.

Stricture of the Rectum.—Stricture of the rectum may be congenital or inflammatory or due to a new growth. The first kind is described on page 323, and the last on page 317.

Inflammatory, or non-malignant, stricture is due to the contraction of scar tissue following long standing ulceration. Frequently stricture and ulcer coexist.

DIAGNOSIS.—The symptoms of stricture are due in part to the obstruction which exists, and in part to the accompanying ulceration. The symptoms of ulcer, as stated above, are pain, diarrhea, the discharge of mucus, pus, or blood, excoriation of the skin around the anus, tenesmus, and spasm, or possibly relaxation of the sphincter muscle. The symptom of the stricture, exclusive of ulceration, is constipation, with its attendant disturbances of digestion. Some patients go for several days without any movement of the bowels. In other cases constipation alternates with diarrhea. In some cases the stool is ribbonlike in character, but this may be produced by a contracted sphincter in cases in which no stricture exists. The symptom has, therefore, little importance except that it indicates the necessity of a thorough examination.

The tendency of most strictures is to grow smaller, and for that reason the symptoms of obstruction are likely to increase. At any time the obstruction may become absolute, just as it does in cases of malignant stricture. When this takes place neither gas nor fecal matter passes the rectum. The abdomen becomes distended, and in the course of four or five days vomiting will probably set in. As these patients are accustomed to infrequent movements of the bowels, complete obstruction will sometimes exist a surprisingly long time before alarming symptoms develop.

Usually, before obstruction becomes complete, the patient will pass through a number of periods of partial obstruction, attended with griping pains, due to increased peristalsis and swelling of the abdomen. Such an attack is often relieved either with or without the use of cathartics and enemas, so that in three or four days the patient's condition is the usual one.

The stricture may be at the anus, for instance, when it follows a badly performed operation for hemorrhoids, or it may be within easy reach of the finger, or it may be at the upper portion of the rectum, and so be beyond the reach of the finger in most cases. It is worth remembering that the rectum can be palpated digitally for a greater distance when the patient is in a squatting position than in any other position. If the finger is able to reach the stricture the surgeon should determine its distance from the anus, its caliber, its distensibility, the amount of surrounding induration, and the presence of an ulcer. If the finger can be passed through it, he should also determine the extent of the stricture, both circumferentially and longitudinally.

Further knowledge of the stricture may be obtained by the use of the proctoscope, and also by the passage through it of olive tipped or flexible bougies.

In the female vaginal and rectal examination combined will often give added information in regard to the extent and form of the stricture.

TREATMENT.—The non-operative treatment of stricture of the rectum consists in the regulation of the diet, which should contain a considerable portion of nitrogenous articles and a good deal of fat; in the use of sufficient laxatives to prevent the accumulation of hard feces above the stricture, and in the daily use of injections to keep the lower bowel empty. If difficulty is experienced in causing the injected fluid to pass the stricture, the enema may be given in the knee-chest position. If the stricture is due to syphilis, mercury and potassium iodid should be given; but little benefit is experienced from their use if the stricture is an old one.

If the above mentioned treatment does not relieve the patient of pain and tenesmus, hot applications to the anal region should be employed. The use of anodynes is to be avoided as far as possible on account of the tendency of these patients to become drug habitués.

Operative Treatment.—Several operations for the treatment of rectal stricture have stood the test of time. They are gradual or rapid dilatation, internal proctotomy, external or complete proctotomy, resection, and, when all other measures fail to overcome the obstruction, colostomy. Only the methods of dilatation will be here described, since the other procedures are outside the domain of minor surgery.

If the stricture is within the area of the sphincter, it should be forcibly dilated by the fingers under a general anesthetic. This will save the patient much time and pain. When a sufficient caliber has been obtained in this manner it may be maintained by the passage of hard rubber plugs every night by the patient himself. If the stricture is above the level of the sphincters, its rapid dilatation, or divulsion, as it is called, produces one or more lacerations of the bowel. These may become infected, and they will almost certainly add to the amount of scar tissue, the contraction of which will have to be overcome in the future. For these reasons gradual dilatation is preferable. This may be accomplished by the finger or by flexible bougies, if the stricture is beyond the reach of the finger. This treatment, to be successful, must be very gentle; violence is sure to excite the formation of additional cicatricial tissue. The bougie, well lubricated, may be passed under the guidance of the finger or, in difficult cases, through a speculum. This last method, recommended by Tuttle, avoids the risk of making a false passage with the tip of the bougie. The first bougie passed should be of such caliber that it enters the stricture easily; the second one should be a little larger, and should remain in position until the stricture somewhat relaxes its hold upon it. In some cases a third may be passed. At the next treatment, two or three days later, the first bougie should be slightly smaller than the largest one employed at the previous treatment. An attempt should not be made to increase the size of the bougies at every treatment, lest too much reaction be excited. During the treatment the patient should be in a lateral position, with the knees well drawn up, and should not attempt to get up for at least fifteen or twenty minutes after the treatment is concluded.

Internal proctotomy is chiefly of service in order to rid the patient of obstruction caused by an annular stricture, or a thin fold of membrane.

Complete or external proctotomy, resection of the rectum, and colostomy or the establishment of an artificial anus, are major operations, which are fully described in text books on surgery, as well as in those on rectal diseases.

CHAPTER XII

TUMORS AND DEFORMITIES OF THE ANUS AND RECTUM

BENIGN TUMORS

Venereal Warts.—Venereal warts, or pointed condylomata, are small papillomatous tumors which form about the anus, as well as in the vicinity of the urethral orifice. They are not strictly of venereal origin, but develop when the skin is kept moist by any sort of an irritating discharge. They are covered by epithelium, which is sometimes so delicate that they bleed at the slightest touch (Fig. 141). They can be distinguished from the broad or syphilitic condylomata by the fact that they always grow from

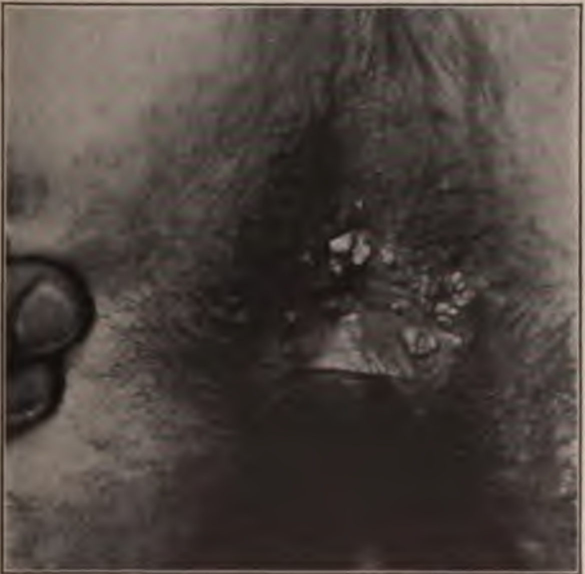

FIG. 141.—VENEREAL WARTS ABOUT THE ANUS OF A MAN AGED TWENTY-THREE YEARS. Duration, six months.

slender pedicles, and they can be distinguished from malignant epithelial growths by the fact that there is absolutely no induration of the underlying true skin.

TREATMENT.—The warts should be clipped off even with the skin by scissors, and the free hemorrhage controlled by hot water and pressure. If the warts are extensive, a general anesthetic is desirable. Recurrence is unlikely if the parts are kept clean and dry.

If the patient is unwilling to undergo this treatment, a slower cure can be effected by the use of caustics, of which monochloracetic acid is one of the best.

Polypus.—This small tumor of the anus or rectum has usually a slender pedicle containing a small artery and a soft body made up of flabby adipose and fibrous or myxomatous tissue, and covered with either normal mucous membrane or with mucous membrane which has undergone adenomatous changes. Such a tumor may be recognized by the palpating finger or it may protrude from the anus. It often gives rise to hemorrhage, but otherwise its presence is not apt to be noticed by the patient, unless it projects externally or becomes caught in the sphincter, causing the patient to feel that all of the fecal matter has not been evacuated. It may also become inflamed and acutely painful. If the polypus is situated above the reach of the finger, an exact diagnosis requires the use of the speculum (p. 281).

TREATMENT.—If the polypus is small and easily accessible it can be ligated and removed through the speculum, or the defect in the mucous membrane may be closed by one or two black silk sutures. If it is of larger size or has a broad pedicle, it is better to etherize the patient, dilate the sphincter, cleanse the rectum, remove the polyp, ligate its vessels, and accurately close the wound by fine black silk interrupted sutures. The aftertreatment is the same as that which should follow the removal of a chronic hemorrhoid (p. 316).

Hemorrhoids.—A hemorrhoid is a more or less pedicled swelling, either within or outside of the anus, which is covered with mucous membrane or skin, and in the center of which are one or more dilated veins. If the hemorrhoid is of long standing it usually contains in addition considerable cicatricial tissue of inflammatory origin.

Hemorrhoids are spoken of as external or internal, according to their situation. Those which are placed so far outward as to rest normally outside the sphincter ani are called external hemorrhoids; others are spoken of as internal, although many of them do not lie wholly within the sphincter.

According to their age and manner of development, hemorrhoids may also be classed as acute and chronic.

Acute External Hemorrhoid.—A hemorrhoid may appear suddenly. While the patient is at stool or lifting a heavy weight, a vein about the anus may rupture subcutaneously, causing the blood to clot in its lumen or, more often, outside of it. There will then be felt upon examination a small rounded tumor, containing in its center a solid elastic clot of blood (Fig. 142). If the mucous membrane or skin which covers it is edematous the blood clot cannot be felt so perfectly.

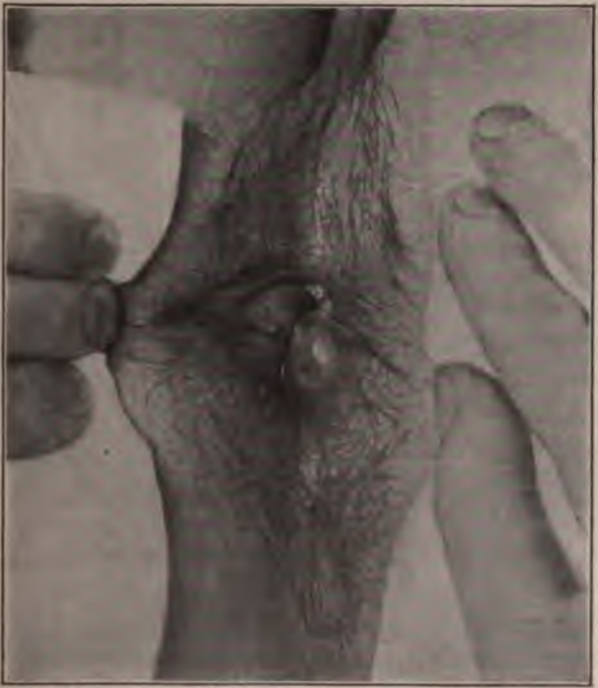

FIG. 142.—ACUTE EXTERNAL HEMORRHOID, ONE WEEK. Note the dark point which indicates a threatened rupture and discharge of the blood clot. Three years previously a similar acute hemorrhoid relieved itself in this way. Patient a man aged forty-four years.

Such a hemorrhoid is sometimes situated wholly outside of the sphincter ani, although it is usually grasped, in part at least, by this muscle. It should not be confused with a true "strangulated hemorrhoid," which is a chronic internal hemorrhoid, prolapsed and pinched by the sphincter.

The symptoms of an acute hemorrhoid are those of discomfort, burning, and, if the affected vein lies within the grasp of the sphincter ani, there will also exist sharp pain, which grows more acute in the lapse of a few hours and which is greatly increased upon defecation, and may even render that act impossible.

If a hemorrhoid of this character is not treated, one of two things will follow. If the pressure upon the overlying mucous membrane or skin is great enough to cause necrosis, the blood clot may be discharged, the patient will be relieved of the symptoms, and the tumor will shrivel up in part and become one of the external tabs of skin so often seen about the anus and which are sometimes called cutaneous hemorrhoids. If necrosis of the overlying skin or mucous membrane does not take place the blood clot will in time become organized, and the tumor will decrease in size, though remaining harder and larger than is the case when the blood clot is discharged.

TREATMENT.— The best treatment for an acute hemorrhoid is radial incision, or excision of the most prominent part of the overlying skin, removal of the clotted blood, insertion of a bit of gauze, or possibly suture of the wound. If the hemorrhoid is situated wholly outside of the sphincter, this operation may be performed in a few seconds, either with or without a local anesthetic. If the lesion has caused great pain, it almost certainly extends upward within the grasp of the sphincter. In this case no operation should be done until after the sphincter ani has been dilated, and for this a general anesthetic is desirable (see p. 282).

If the external acute hemorrhoid is not seen until the symptoms are subsiding, and the danger of necrosis of the skin is past, it may be well to postpone operation and allow the thrombus to organize and shrivel up. At any rate operation at this stage will not be followed by the prompt collapse of the skin and quick restoration to normal which follows operation when the clot is freshly formed.

External tabs of skin, the so called cutaneous hemorrhoids, the result of previous acute hemorrhoids, usually give rise to no symptoms. If their presence is disfiguring they should be removed and the resulting wounds sutured radially to the anus with fine black silk.

Chronic Hemorrhoid.—Another form of hemorrhoid which may be spoken of as chronic to distinguish it from the acute form above described is due to constipation. The dry hard fecal matter clings to the mucous membrane above the sphincter, and a strong abdominal pressure exerted by the patient to expel the feces dilates the veins of the rectum and those about the anus. In the normal individual in perfect health defecation can take place without straining, since the peristaltic action of the intestine is continued down to the anus, and is sufficient to expel the fecal mass. When the feces is allowed to remain for hours each day in the rectum, the latter becomes tolerant of its presence, so that it is difficult to excite it to peristaltic action during the act of defecation.

In time the dilatation of the veins become permanent, and although the change may not be noticeable when the parts are at rest, it is evident when the patient strains. This gives a puffy appearance to the skin around the anus. These dilated masses of veins, with their covering of skin, are called chronic external hemorrhoids.

From this repeated straining at stool, and from the long retention of feces in the rectum, the caliber of the lower portion of the rectum becomes excessive, and when it is empty the superfluous mucous membrane is naturally thrown into folds. Such a fold covering a mass of dilated veins is known as an internal hemorrhoid. At each defecation it is dragged downward, and in time comes to assume the shape of a pedicled tumor. One or more of these internal hemorrhoids may protrude from the anus after defecation until replaced by the fingers (Fig. 143).

If the hemorrhoids are large and the sphincter ani by reason of the irritation of the parts has tightened its grasp, the reduction of the hemorrhoids may be attended with difficulty. In this manner a true strangulation of a hemorrhoid may take place, and result in gangrene of a portion of its mucous membrane.

In the usual case of chronic hemorrhoids, there may be one or two of the folds above described or a complete circle of them, or the whole lower segment of the rectum may become so loosened and dilated that it turns outward during the act of defecation, thus simulating the normal behavior of the rectum of the horse during defecation.

SYMPTOMS.—The symptoms arising from chronic hemorrhoids vary greatly according to the situation of the dilated veins and whether or not inflammation is present. Chronic external hemorrhoids existing alone often give rise to no symptoms whatever, or possibly to a slight burning sensation after defecation, possibly to pruritus. Internal hemorrhoids, on the other hand, are far more painful, and when well developed they bleed easily and interfere with defecation. These patients are almost invariably constipated, and while constipation is one of the chief factors in the causation of hemorrhoids, it often happens that laxatives by temporarily increasing the size of the tumors, and the freedom with which they protrude, add to the discomfort of the patient. The pain may be constant or it may be caused by defecation, and last for half an hour or so after the rectum has been emptied. The hemorrhage is of variable quantity. It is usually due to abrasions of the mucous membrane, caused by the passage of hard fecal matter through the sphincter, or to abrasions caused by the patient, if the mucous membrane protrudes from the anus and he uses a

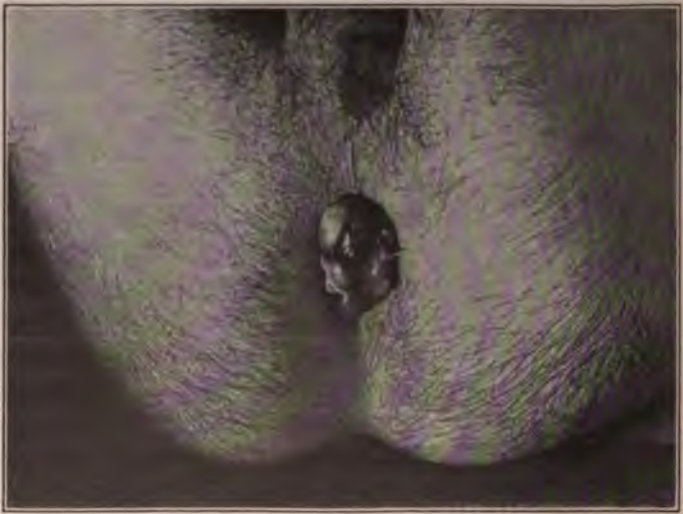

FIG. 143.—INTERNAL HEMORRHOIDS OF SIXTEEN YEARS' DURATION. Patient aged fifty-two years.

rough, dry paper to cleanse himself or to relieve the itching. Hemorrhage may also be due to congestion or ulceration within the rectum; and if so, it usually occurs in greater quantity than when it is due to the mechanical abrasions spoken of. The itching may be intolerable. This may be the chief or only symptom of hemorrhoids, and hence the term itching piles. It is apparently due to the disordered circulation about the anus, and if so, disappears with the relief of the hemorrhoids. But pruritus ani may exist without hemorrhoids (see p. 287), and may therefore coexist independently.

TREATMENT.—The non-operative treatment of hemorrhoids is of importance because it may relieve all symptoms in the milder cases, and because many patients absolutely refuse operation, even when it is clearly indicated. If the regulation of the diet and mode of life is not sufficient to overcome constipation, mild laxatives should be given. Straining at stool is to be avoided, even though a small injection of cold water has to be used each time. The patient should make it a practise after the rectum is empty to contract the sphincter four or five times with considerable force. Bathing with cold water will also improve the tone of the tissues, and, when possible, these measures should be followed by a few minutes' rest in a recumbent position or with the hips elevated.

Local treatment will naturally be directed to the relief of the most annoying symptoms: thus, if the patient is annoyed with itching, the parts should be painted with a five per cent solution of carbolic acid or a salve containing tannic acid and ichthyol, each one part, belladonna ointment and the cerate of lead subacetate, each five parts. For the bleeding and pain of internal hemorrhoids, a multitude of salves and suppositories has been recommended. Perhaps as good as any is a suppository containing two grains of iodoform and five of tannic acid, with the addition of a small quantity of morphine, if the pain is great.

Hemorrhage is for the most part not serious, unless on account of its frequent recurrence. Any particular bleeding either ceases spontaneously or will usually do so as soon as the patient assumes a horizontal position or applies cold and pressure to the anus.

A prolapsed hemorrhoid can usually be replaced by a few moments' steady pressure. This is more effectual if the mucous membrane of the opposite side of the bowel is drawn outward before the pressure is made. Its return will then assist in dragging the prolapsed hemorrhoid back into place. The patient usually learns to make this manipulation himself. If he fails on account of pain or swelling, the prolapsed hemorrhoid will rapidly increase in size, so that in an hour or two its reduction will be more difficult. If left out for a longer period it may become gangrenous in part.

The application of cold by an ice-bag or cracked ice will reduce the swelling and favor reduction. Constant elastic pressure obtained by a big pad of nonabsorbent cotton and a firm T-bandage may in an hour or two reduce the prolapsed hemorrhoid. The cotton should be separated from the hemorrhoid by a layer of gauze spread with any simple ointment.

If these measures fail, or if immediate reduction is desirable on account of intense pain, the patient should be given a general anesthetic and the sphincter ani dilated. Return of the prolapsed hemorrhoids is then accomplished with the greatest ease. A rubber tube left in the rectum will allow the escape of gas.

While the palliative treatment above indicated will relieve the symptoms in mild cases of hemorrhoids, they are ill adapted to severe cases. In these the gross lesions are so marked that one does his patient an injustice who does not advise him to submit himself to operation.

OPERATIVE TREATMENT.— The curative treatment of chronic hemorrhoids consists in the dilatation of the sphincter ani and the removal of the superfluous skin or mucous membrane and the underlying dilated veins. This may mean the removal of a single fold or several folds, or the removal of a complete circle of the bowel in cases in which there is so much prolapse. The wounds caused in the mucous membrane and skin should be carefully stitched with fine black silk after the veins and arteries have been ligated and excised. In other words, the same surgical principles should be applied here as are followed in the removal of superfluous tissue in other portions of the body. No one would think of clamping an angioma of the cheek, ligating or cauterizing its stump, and leaving the wound to heal by granulation. The rectum should be treated with no less respect. The rapidity with which the parts will heal, the absence of pain, and the lack of any visible scar will be a surprise to those who have only seen hemorrhoids treated by the older methods. As far as possible the suture lines should be made longitudinal to avoid subsequent contraction of the anus.

Technic of Operation.—Whenever possible, three days should be allowed to prepare the patient for operation, as this preparation is most important. The bowels should be thoroughly moved three days before operation and two days before operation. On the day immediately preceding operation one or two rectal enemas should be given. After this the rectum should not be disturbed. It will then be found clean and free from fluid at operation. For the last day the diet should be fluid and of a character to leave little residue, and a small dose of morphine may be given a few hours before operation.

The patient is anesthetized and placed in the lithotomy position. The sphincter is slowly but completely dilated (p. 282). A bivalve speculum is inserted and opened in different directions, so that the operator may determine the amount of hemorrhoidal tissue which it is desirable to resect. The speculum is removed and an individual hemorrhoid is clamped longitudinally. The mucous membrane and the skin, if the hemorrhoid extends so far downward, is divided on either side of the clamp, and dissected and pushed back from the central mass of vessels. The pedicle of the hemorrhoid, which is composed chiefly of vessels, is transfixed and ligated in two sections with fine catgut. The upper portion of the wound in the mucous membrane is then closed by a continuous suture of fine chromic catgut. Before this is drawn taut the portion of hemorrhoid included in the clamp is cut away. Care should be taken to cut far enough away from the ligatures on the pedicle so that they will not slip off. The chromic catgut suture is then continued until the wound is closed; or if preferred the upper half of the wound only is closed in this way, and the lower half is stitched with fine black silk. This causes less irritation, and almost never suppurates; but it is difficult to remove, without anesthesia, stitches more than an inch above the normal lower level of the anus.

Other hemorrhoids are treated in this manner until the normal contour of the bowel has been restored. One should be careful not to remove too much of the mucous membrane and skin, especially in the anal canal, lest a stricture result. It is rarely desirable to remove more than four clampfuls of tissue. The clamp should never contain more than one-eighth of the total circumference of the bowel.

Internal hemorrhoids are often continuous with external ones, and if such is the case, the radial excisions of mucous membrane should be continued outward far enough to remove the surplus skin, and permit the ligation and excision of the dilated underlying veins. The remaining skin will " fit " more smoothly if the line of suture, strictly longitudinal within the rectum, becomes a spiral one when it passes outside of the anus.

Postoperative Treatment.—After the operation the patient should be kept on a fluid diet for two days. The white of an egg, stirred raw into a half-glass of water, probably leaves as little residue in the intestine as any form of nourishment. A little fruit juice may be added for taste. This may be given every two or three hours. The bowels should be moved by a laxative on the third or fourth day, and after that the patient may get up, though if he can afford a longer rest, so much the better.

All things considered, this plan of treatment seems the best that has been devised. It is the cleanest, gives the smallest wound for the work done, and is followed in most cases by primary union. The various forms of office treatment by means of electrolysis, injections of carbolic acid, etc., prolong the patient's discomfort for several weeks, even if they do not add to it, and often fail to effect a cure.

MALIGNANT TUMORS

Carcinoma.—Cancer of the anus and rectum is a common disease, especially in men over thirty years of age. It may originate in the skin around or within the anus, in which case it is a squamous epithelioma; or it may originate in the mucous membrane of the rectum, in which case it may be of any one of the types of cancer which are found growing from mucous membrane. In more than one-half the cases the tumor involves the supraperitoneal portion of the rectum; while in about one-fourth of the cases it involves the infraperitoneal portion of the rectum or the anus. In these latter situations it is easily accessible to the finger, and there is, therefore, the less excuse for failure to make an early diagnosis. Yet so strong is the dislike of many physicians for a rectal examination that patients are frequently seen with well developed carcinoma of the rectum who have been treated for constipation, hemorrhoids, etc., for months without a physical examination being made. This is a sufficient excuse, if any is needed, for introducing this serious subject into a book on minor surgery.

DIAGNOSIS.—The diagnosis in anal carcinoma is easily made, since at least a part of the growth is visible. There will be induration of the skin and a hard tumor, slightly elevated, and presenting in its older portions cracks or ulcers partially covered by scabs. Microscopic examination of a section of the tumor will remove any doubt which may exist as to its nature.

The early symptoms of carcinoma situated above the anal canal are irregularity in the stools, constipation or diarrhea, and a discharge of mucus or pus or blood, the discharge usually having an extremely foul odor. The discharge frequently causes erosions of the skin about the anus. The amount of pain varies in different cases. The fact that it is often a late symptom is no doubt one reason why these tumors sometimes attain so great a size before surgical aid is called for.

If the carcinoma is within reach of the finger, it can be recognized as a hard, nodular growth, more or less elevated above the level of the mucous membrane of the rectum. It is inelastic, so that if it extends through more than one-half of the circumference of the rectum, the caliber of the latter is distinctly reduced. If it extends all the way around the rectum, there is usually a well marked stricture.

The fact that no tumor can be reached with the finger is no proof that the rectum is free from cancer, since it may be situated too high up to be accessible in this manner. In every such case, therefore, an examination with the speculum should be made.

Sarcoma.—Sarcoma of the rectum starts outside of the mucous membrane, so that at first the mucous membrane is movable over it. For the same reason ulceration is not an early symptom, nor is gangrene of the surface, with its characteristic odor, so prominent a symptom. Sarcoma may obstruct the rectum by its bulk, but does not tend to form a cicatricial stricture.

TREATMENT.—This is not the place to consider the treatment of cancer of the rectum, but the matter is such an important one that it cannot be insisted upon too strongly that every physician who is consulted by a patient for the relief of rectal symptoms should make a careful digital examination, and if the diagnosis is not perfectly clear, an examination with the speculum should also be made. Were this the rule fewer malignant troubles would go so long unsuspected.

ACQUIRED DEFORMITIES

Prolapse.—Acute prolapse of the rectum is often seen in young infants. At an early age the rectum is a delicate structure, more like the small intestine in the adult than like the adult rectum. It is loosely attached in the pelvis, and is therefore easily everted by excessive straining at stool, either the result of constipation or of diarrhea. Such a prolapse usually measures from one to three inches in length and can hardly be mistaken for anything else. It is a soft tumor covered with mucous membrane, either in a normal state or congested or edematous or gangrenous, according to the amount of constriction of the anus and the duration of the prolapse.

It sometimes happens that an invagination of the gut above the rectum may appear at the anus. Even so high an invagination as that of the small intestine through the ileocecal valve has been known to protrude from the anus. Under these circumstances the protruding gut is apt to be in a serious condition. If the rectum alone has prolapsed its vitality is not seriously affected in most cases.

TREATMENT.—The treatment indicated in acute prolapse is the immediate replacement of the protruding bowel. The patient should be placed in some position which will bring the hips well above the epigastrium. A small child may be inverted, if this can be done without exciting crying. Delicate manipulation with the fingers will usually succeed. As in reducing a hernia this may be carried out in two ways: The protruding mass may be grasped with the hand and compressed, much as one compresses the bulb of a hand syringe. This pressure may force the central part of the prolapse back into the rectum, and if so the rest will easily follow. The other method is to push upward the lowest part of the prolapse with the finger. The trouble with this method is the difficulty in preventing the prolapse from recurring when the finger is withdrawn. A good plan is to wrap the finger with dry gauze or tissue paper, which sticks to the mucous membrane, and then by rotation of the finger to unwind this from the finger, leaving it in the rectum until the prolapse has been entirely reduced.

It is necessary to prevent a recurrence of the prolapse for some weeks. Sufficient laxatives or enemata should be given to prevent straining at stool. Defecation should take place in a horizontal position, either on the back or side. The buttocks should be tightly strapped together with adhesive plaster. If this becomes soiled, the central part should be cut away and new strips placed over the old, as the daily peeling off of the old and application of new strips will make the skin sore in a short time.

In infants a cure can almost invariably be effected by these means.

If the prolapse is due to an invagination above the rectum, merely crowding the gut back within the anus will not of course relieve the trouble. Something may be accomplished, however, digitally or by the injection of warm oil combined with inversion of the patient. If these simple means are not sufficient to effect a cure within a few hours after the first symptoms, laparotomy should be performed.

Chronic Prolapse.—In the lesser degrees of this condition there is a protrusion after defecation of the mucous membrane. In the severer degrees not only the mucous membrane, but all the coats of the rectum are turned out, and when replaced, they again prolapse as soon as the patient assumes an upright position and takes a few steps.

The causes of chronic prolapse are the same as the causes of chronic hemorrhoids, namely, dilatation and atony of the rectum and straining to expel a constipated movement. Prolapse is also favored by the overstretching or laceration of the perineum at childbirth, by unwise operations upon the rectum leading to paralysis of the sphincter ani, as well as by the relaxation of the tissues which comes with old age. It is therefore especially frequent in old and feeble persons, though by no means confined to them.

Diagnosis.—The symptoms are slight, the annoyance of the protruding mass covered with mucous membrane being often the only one. If this ulcerates, there will of course be a purulent and slightly bloody discharge. The diagnosis is always easy, though it may not be so easy to say just what is the degree of prolapse, nor whether it is accompanied by a hernial protrusion or not.

TREATMENT.—The treatment outlined for acute prolapse cannot be expected to cure chronic prolapse; the conditions are too different; and yet something may be accomplished by attention to the bowels, the use of cold water both within and outside of the rectum to tone up the muscles, and by rectal and abdominal massage. Astringents may also be used within the rectum (see p. 313) or applied to the protruding bowel.

The bowel may be stiffened by the injection of irritating fluids into its tissues, or by the cauterization of its surface. It is evident that anything which will reduce the flexibility of the rectum will make it less easy for a prolapse to occur. It is claimed by the advocates of this plan of treatment that the caliber of the rectum is also reduced thereby. A fluid commonly employed for intramural injection is composed of the following substances:

℞	Salicylic acid	1	part;
	Sodium biborate	2	parts;
	Carbolic acid	4	"
	Glycerin	16	"

A few minims are injected in two or three places around the neck of the prolapse, and after a few minutes the reduction is made. For two weeks thereafter the patient should keep the buttocks strapped together, and should defecate in a horizontal position.

Cauterization of the protruded rectum may be performed with a strong acid or with the Paquelin cautery. It is recommended that this cauterization be made in longitudinal lines, from four to six according to the size of the bowel. Another plan is to reduce the prolapse and insert a speculum having six narrow slits in it, so placed that they are wholly above the anal canal when the speculum is inserted. The mucous membrane projects through these slits into the lumen of the speculum, and can be readily and accurately cauterized.

If these simpler measures fail there are a number of operations to choose from, such as excision of longitudinal or circular strips of mucous membrane; enfolding of a longitudinal fold of the whole rectum through a posterior incision; suspension of the rectum through a posterior or an abdominal incision, etc. The details of these and other operations are found in special and general text-books.

Rectal hernia, with prolapse of a part of the rectum, is found in women whose sphincter ani has been damaged in childbirth. Such a prolapse is of the nature of a hernia, the outer portion of which is covered with the everted mucous membrane and within which there may be a portion of the vagina or the uterus or the intestine or other contents of the peritoneal cavity. Such a hernia is always easily reducible. Its cure is to be sought by restoration of the sphincter ani.

Incontinence of the Sphincter Ani.—Inability of the patient to retain his feces may be due to a great number of causes, such as injury to the spinal cord, other forms of paralysis, rupture or division of the sphincter, rigidity of the anal canal, as seen in cases of malignant disease, etc.

A patient may be able to retain solid fecal matter, but unable to retain fluid feces. This is frequently the case after resection of the rectum for malignant disease.

DIAGNOSIS.—The diagnosis of incontinence is easily made from the statement of the patient or those who care for him. But the mere knowledge of this one symptom is not a satisfactory diagnosis. The physician must ascertain whether incontinence exists at all times, and if not, under what circumstances it occurs. He must also continue his examination until he has learned the exact cause of the lack of control. If proctitis exists, or an ulcer or a stricture or malignant disease, appropriate treatment is to be instituted. If the loss of sphincteric control has followed a traumatism or an operation for hemorrhoids, fistula, or abscess, the physical examination should reveal the ability of the patient to contract the sphincter ani muscle or its segments in case it has been divided in more than one place. These are the cases in which a slight operation may cure or benefit a patient otherwise very miserable.

TREATMENT.—If examination shows that there is no paralysis of the sphincter, but that loss of control is due to separation of the cut ends of the muscle, an operation should be performed to reestablish its continuity. This should not be performed as long as any ulcer or sinus exists.

The patient should be prepared as for other rectal operations (p. 315). A general anesthetic is desirable. A circular incision should be made at a distance of a half inch or more from the margin of the anus, and long enough to expose the cut ends of the sphincter ani. Both of these are freed by careful dissection, the intervening scar tissue is cut away, and the clean ends of the muscle are closely approximated by three or four sutures of fine chromicized catgut prepared to resist absorption for twenty days. The skin wound is sutured with fine black silk. Primary union is striven for and often obtained; but should this not be the case the ultimate result of operation may still be satisfactory if the deep sutures hold the muscular ends firmly together until granulation is complete. Hence the desirability of suturing the muscle with a catgut which will resist absorption for three weeks.

The bowels should be kept quiet four or five days. Oil injections should then be administered and mild laxatives. After the movement the parts should be carefully cleansed.

This treatment by restoring the original condition is the best that can be employed. Unfortunately it is many times inapplicable, either because of wasting of the sphincter or paralysis of a part or the whole of the muscle or on account of the loss of the muscle, as after many cases of rectal resection. Under such circumstances attempts have been made to establish continence by a purse string wire suture introduced subcutaneously and allowed to remain; by twisting of the rectum and suture in its new relations; and by other plastic operations described in special text-books.

Much can be done to relieve the patient by keeping his stools in a solid condition and by washing out the fæces regularly once or twice a day. If all these measures are of no avail, the question of left inguinal colostomy should be considered. A continent artificial anus in a situation where it can be cared for by the patient is in many respects better than an incontinent natural anus.

CONGENITAL DEFORMITIES

Imperforate Anus.—The only important malformation of the anus or rectum is a lack of communication of the lumen of the bowel and the outside world through the anus. The lower bowel may terminate in the vagina, and normal defecation take place in this manner for years. There may be only a minute opening between the anus and rectum—a congenital stricture. There may, however, be no opening to the bowel, and unless this condition is relieved within a short time after birth the death of the infant must follow. The anus and the sphincter ani may or may not be normally present. If the external structures are perfect and the bowel reaches to within a quarter or half an inch of the skin, an opening is easily made through the septum, and the continuity of the lumen is restored. If the distance from the lower end of the rectum to the surface is more than half an inch it may be difficult to find the rectum at operation, and some surgeons consider colostomy preferable to a prolonged attempt to find the bowel. One of the difficulties of finding the lower end of the rectum is the fact that instead of being situated immediately above the imperforate anus, it is often deflected one way or another, usually lying anterior to its normal situation. In these cases the mortality after operation is high, as it is also after colostomy for imperforate anus. If merely a congenital stricture exists, it may be dilated or divided, according to circumstances. If dilation is easily performed, it is preferable, as a wound is thereby avoided.

SECTION VI

AFFECTIONS OF THE ARM AND HAND (UPPER EXTREMITY)

CHAPTER XIII

INJURIES TO THE SOFT PARTS OF THE ARM AND HAND

The upper extremity is especially exposed to traumatism. Fractures of the various bones in the arm and hand constitute a large part of all fractures. The proportion of slighter traumatisms is perhaps larger. Moreover so many important structures lie close to the skin of this part of the body that a slight injury may have serious effects. Familiar examples are an incised wound of the front of the wrist, opening the radial or ulnar artery, or dividing some flexor tendons; a burn of the palm, producing permanent flexion of the fingers; suppuration involving a tendon sheath, and preventing further motion of the tendon.

Contusions.—Diagnosis of contusion is easily made from the redness and abrasion of the skin, tenderness on pressure, ecchymosis, and swelling. If there is loss of function, or if manipulation of the underlying bone is painful, search should be made for a fracture or sprain. It may be difficult to differentiate a contusion involving a bone, from a partial fracture, or a fracture without displacement. Without the aid of the X-ray it may be necessary to wait a week or two, to see if the symptoms of deep tenderness and disability disappear before asserting positively that the bone is uninjured.

Treatment.—The treatment of simple contusion is given on page 2. A sling is in most cases advisable. It is less conspicuous if made of a black silk handkerchief or a black ribbon two or three inches in width; or if the patient's pride does not permit even this, he may keep his hand between the second and third buttons of his coat.

Contusions about the joints are often associated with sprains, and they are therefore discussed under that heading.

Blister.—A blister is the lifting up of the superficial portion of the epidermis with serous or seropurulent or bloody fluid. Blisters are common lesions in many diseases. They are also seen in burns and frost-bites. They also follow traumatism. The last is the only type of blister which will be here considered. The traumatism may be a slight, oft repeated friction upon skin unaccustomed to it or a sudden more severe traumatism, usually in the form of the pinching of the skin. Blisters of the first type are common upon the palms of the hand, from rowing a boat or using heavy tools, and upon the heels and toes as a result of an unusual amount of walking. Blisters of the second type usually contain a certain amount of blood, and are called blood-blisters. Such a blister is a small hematoma (v. infra).

TREATMENT.—In the treatment of a blister the object is to protect the tender underlying epithelium for a few days until it becomes harder. Hence the blister should not be removed, but its fluid should be withdrawn by the oblique passage into it of a needle, which enters the sound skin about an eighth of an inch away from the edge of the blister. The skin should first be cleansed with alcohol, and the needle passed through flame to prevent infection. If the whole blister has been torn away, the underlying skin should be protected by a wet dressing or a cotton-collodion dressing or a simple ointment.

If a blister contains pus, all of the raised epithelium should be at once cut away and a wet antiseptic dressing applied.

Hematoma.—The description and treatment of hematoma of the head (p. 2) is applicable to hematoma of the arm. There are, however, two special forms of hematoma peculiar to this region.

Hematoma Beneath the Nail.—If the blood is poured out beneath the nail, this is wholly or partly lifted from its bed, and even then the unrelieved pressure may cause the patient great pain. As the bluish red of the clotted blood shows through the translucent nail the diagnosis is unmistakable (Fig. 144).

Treatment consists in cutting away a narrow transverse strip of the nail near its base to relieve the pressure and prevent suppuration (Fig. 145). If the base of the formed nail has been separated from the matrix, it should be freed from the overlying skin with the point of a knife and removed. If the whole nail has been loosened, it should be thus freed from the skin and removed. In any case a dressing should be kept over the finger for a few days to prevent dirt from making its way beneath the loosened nail and to protect the tender bed of the nail.

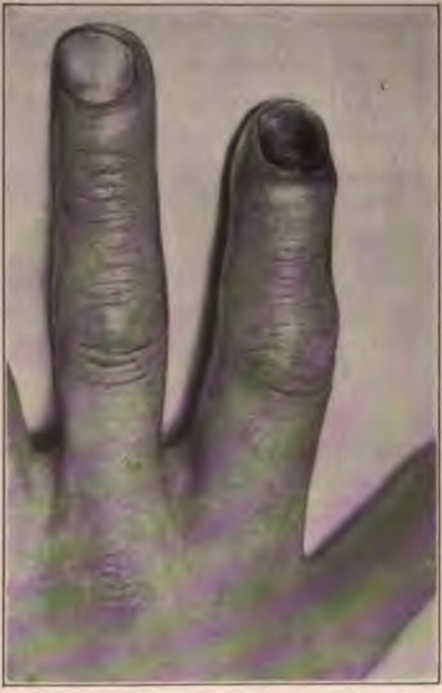

FIG. 144.—HEMATOMA BENEATH THE NAIL. The skin is lifted by the formed nail, the outline of which is readily seen.

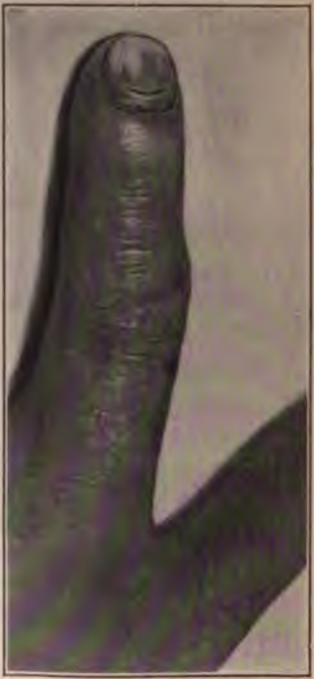

FIG. 145.—INCISION FOR EVACUATION OF THE BLOOD IN HEMATOMA BENEATH THE NAIL.

Cutaneous Hematoma or Blood-blister.—Small hematomata are produced in the palmar skin by pinching or by continued rubbing, as of an oar. They usually contain bloody serum and are called blood-blisters. The contents of these blisters should be pressed out through the channel made by passing a clean needle through sound skin into the blister. This evacuation may have to be repeated once or twice.

A blow upon the olecranon or upper part of the ulna may produce a large hematoma. The circulation in this region is not very active, and if the skin is broken and the wound neglected the hematoma may suppurate, even when there is no apparent connection between the superficial wound and the hematoma. The treatment is then that of an abscess (see p. 408).

Rupture of the Biceps Muscle.—The biceps muscle may be partly or completely torn, usually by an attempt to lift a too great weight. This accident occurs almost exclusively in men, and usually in those who have passed their prime, or in those whose muscles have been weakened by alcoholism or disease.

The history given is that of sudden pain in the arm during a strain, followed by muscular weakness. If the muscle is only partially torn, the patient is able to flex his forearm, but with nothing like the usual power.

Physical examination confirms the statement of the patient as to the loss of muscular power of flexion, especially when the forearm is supinated. Careful palpation will usually reveal a depression at the site of rupture. This may be in either the tendinous or muscular portion of the biceps. Moreover, when the patient attempts to contract the muscle it remains flabby, although he may move it to a certain extent. If only a part of the muscle or one of its heads is ruptured, this part will remain flabby while the remaining portion is firmly contracted. Sometimes the retraction of the torn portion of the muscle forms a noticeable bunch.

Treatment.—The treatment may be operative or non-operative. In young and healthy subjects the rupture in the muscle or tendon should be exposed by a longitudinal incision, the torn ends sutured by fine silk or fine catgut chromatized to resist absorption in the tissues for twenty days or more. The skin should be sutured without drainage, and the forearm kept in a flexed position by a broad sling, or, if the patient cannot be trusted, the arm should be fixed in this position by a light gypsum or starch bandage. This should be kept up for two or three weeks, after which passive motions, and later active motions, may be resumed.

If the rupture is slight, or if the general condition of the patient makes an open operation seem useless, non-operative treatment is indicated. The forearm should be flexed at a right angle and carried in a sling. Massage may be employed every day or every second day, pressure being so directed as to approximate the torn ends of the muscle. Bandages or strips of rubber adhesive may also be employed toward this end.

Wounds.—Punctured wounds of the hand or fingers rarely give rise to troublesome hemorrhage, but they are often followed by suppuration.

Bites of men and animals should be regarded as punctured wounds, and should receive the same treatment.

COMPLICATIONS.—Incised wounds are significant because underlying structures are often injured, even though the superficial wound is small. This is especially true if the instrument causing the wound is very sharp, as a chisel or a pointed fragment of glass. The possible complications of such a wound are incision or division of an artery or nerve, or one or more tendons, or the opening of a joint. The radial and ulnar arteries are superficial in the wrist, and are often injured. One is wont to think of the ulnar artery as lying close to the ulnar side of the forearm, forgetting that in the wrist where this vessel is superficial it makes a sharp curve toward the radial side to clear the head of the ulna and the pisi-

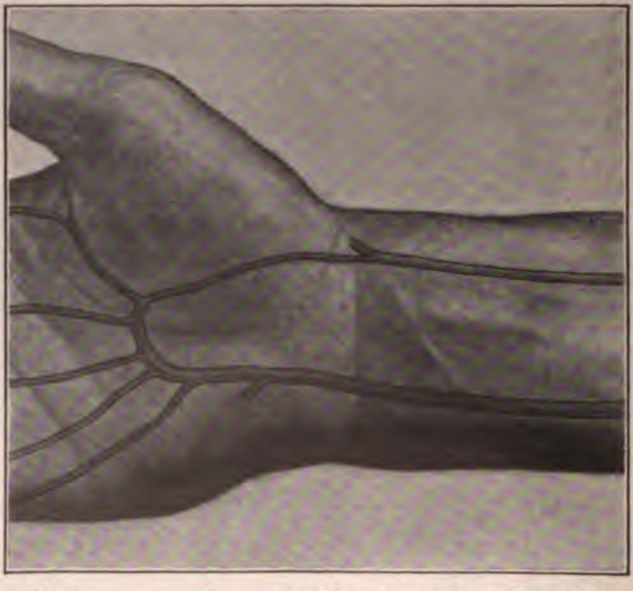

FIG. 146.—POSITION OF THE RADIAL AND ULNAR ARTERIES AT THE FRONT OF THE WRIST. The curve of the ulna toward the center of the wrist, as it passes the head of the ulna, is often more pronounced than it is here represented. Somewhat diagrammatic.

form bone (see Fig. 146). Hence it is often opened in transverse cuts, which are, roughly speaking, in the middle of the wrist.

The ulnar nerve may be cut at the elbow between the inner condyle of the humerus and the olecranon. This produces paralysis of the flexor carpi ulnaris, inability to separate the fingers, loss of sensation of the outer half of the ring finger and of the little finger in front and behind. Division of the ulnar nerve at the wrist gives the same symptoms in the hand.

If the radial nerve is divided at the wrist, sensation is lost in the back of the thumb and index-finger. There is no muscular paralysis.

If the median nerve is divided at the wrist its muscular branches to the flexors of the forearm are, of course, not affected. There will be inability to abduct the thumb and loss of sensation in the palmar surface of the thumb and index-finger.

The symptoms here given are not all the changes which follow these nerve injuries, but they are the most striking ones and are sufficient for diagnosis. It is best to disregard sensation in the middle finger, as anastomosis may give misleading symptoms.

The tendons most often divided in wounds of the arm are those of the muscles which have their origin in the forearm and their insertion in the hand. Twenty-three such tendons pass through the annular ligament. They may be cut either in the wrist, hand, or fingers. Most of them are easily palpated when put on the stretch by resisted voluntary motion, and a comparison with the other hand will usually show whether any one of them is divided; but if in doubt, the medical attendant will do well to postpone suture of the wound in the skin until he has refreshed his anatomical memory.

The action of the deep and superficial flexors of the fingers may be distinguished as follows: If both are divided, the finger cannot be flexed with any considerable force. The lumbricales and interossei have only a feeble action as compared with the normal flexors. If the tendon of the flexor profundus to any finger is divided, the patient cannot flex the terminal phalanx when the second phalanx is held extended by the surgeon (Fig. 147). If the tendon of the sublimis is divided, the patient cannot flex the second phalanx when the first is held extended, or at least not until after the third has been well flexed on the second. With division of the sublimis, the test position shown in Figure 148 cannot be assumed.

Joints of the arm and hand are most exposed to incision on their posterior aspect. The metacarpo-phalangeal joints are opened far more frequently than the others.

TREATMENT.—The treatment of wounds of the arm and hand consists in the removal of any dirt, the control of hemorrhage, the approximation of the tissues by suture if necessary, and a dry dressing, or, if the cleansing is doubtful, a wet dressing. (For the details of such treatment see p. 13.) The skin of the hand or finger should not be cut away simply to obtain a straight line of suture. It is well supplied with blood, and heals rapidly.

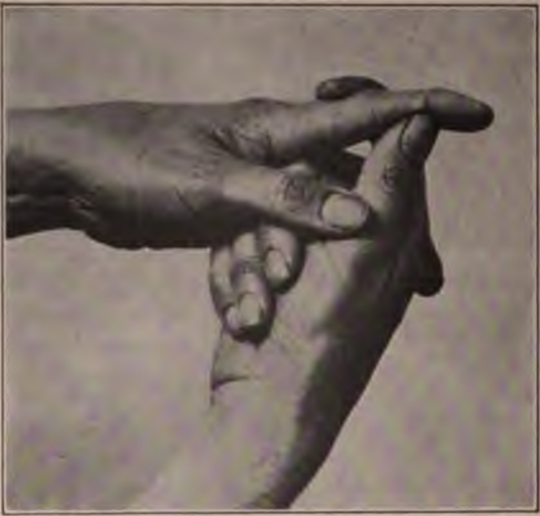

FIG. 147.—TEST FOR DIVISION OF THE PROFUNDUS TENDON. When the second phalanx is held extended the terminal phalanx cannot be flexed voluntarily if the profundus is divided.

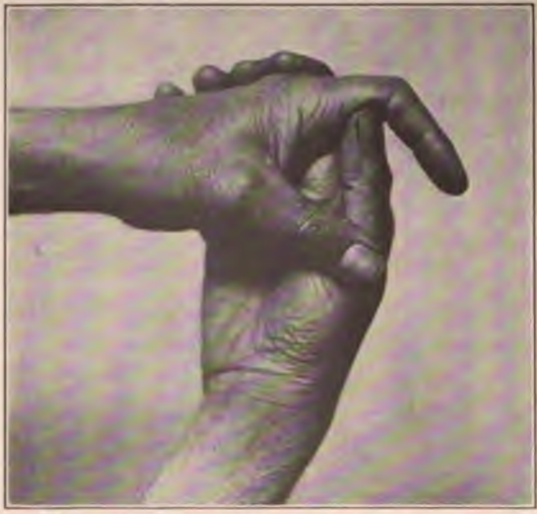

FIG. 148.—TEST FOR DIVISION OF THE SUBLIMIS TENDON. When the first phalanx is held extended, the patient cannot flex the second; certainly not until the terminal phalanx has been flexed—in cases of division of the sublimis.

If a portion of skin has been destroyed in such a manner that the edges of the wound cannot be sutured, an ulcer will result. If this is so shallow that islands of epithelium are left in its base it will quickly become covered with new skin. If the whole thickness of skin is destroyed, the gap should be covered with skin grafts if it is more than one inch in diameter. The diameter of an ulcer left to close by marginal growth will diminish only by about one-quarter of an inch a week, and the epithelium in a large scar thus produced is inferior to that of a Thiersch graft. The grafts may be applied to a fresh wound, after it has been cleansed and the hemorrhage stopped, or to the resulting ulcer, when its base is thickly covered with granulations (Fig. 149).

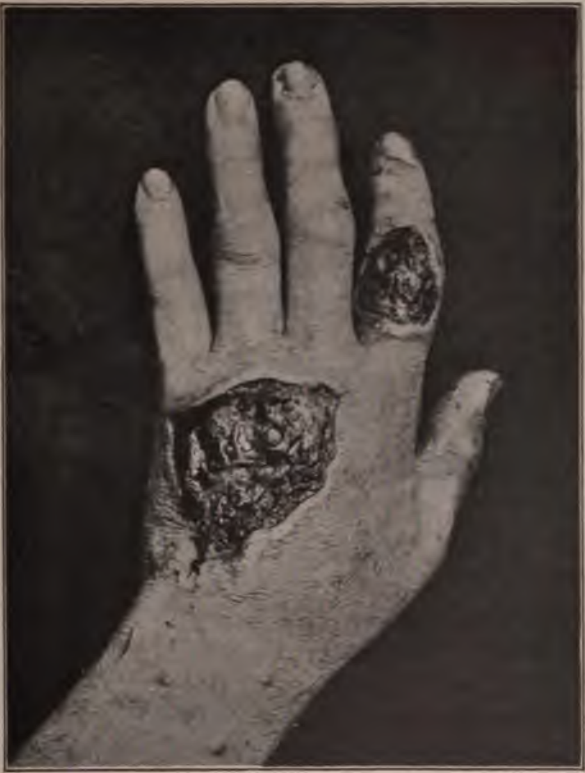

FIG. 149.—TRAUMATIC ULCERS OF THE HAND; DURATION SEVENTEEN DAYS; ACTIVE GRANULATIONS. In good condition for skin-grafting. Patient aged fifty years.

Treatment of Minute Wounds of the Fingers.—A pin-prick or other wound of the finger or hand, insignificant in itself, may yet be the starting-point of a serious inflammation. Indeed, most of the suppurations of the upper extremity begin in such minute wounds. Their proper treatment is, therefore, a matter of no small importance. Probably no method of treatment can afford infallible protection from infection, but in a rather extensive experience with this class of wounds the author has never known infection to extend beyond the immediate area of the wound, and rarely to manifest itself even there when the following rules have been observed:

1. Make the wound bleed promptly by pinching it, sucking it, and, if necessary, enlarging it.
2. Cleanse the adjacent skin by vigorous scrubbing with strong antiseptics, such as turpentine, ether, or bichlorid solution.
3. Shave away any surplus dead epithelium.
4. Apply a wet antiseptic dressing for a few hours.
5. If the wound contains visible foreign material, e. g., rotten wood from a splinter, or has been made by something probably covered with pyogenic germs, e. g., an old fish-bone, it should be laid open and drained if its track can be followed.
6. The wound should be inspected on the following day, and if it is indurated and tender, an incision should be made through the indurated area only. A minute drop of pus may escape.

Ligation of Vessels.—If a wound has opened a vessel of sufficient size to require ligation, the incision, if such is necessary, should be made in the long axis of the limb, even though this makes an irregular wound. Before the vessel is tied with No. 1 or No. 2 catgut it should be entirely isolated, so that no nerve may be included in the ligature. A local anesthetic is satisfactory, but some patients prefer a general one in order to avoid the nervous shock. Suture of the skin with horsehair or fine black silk, and a dry dressing, together with a splint and sling if the wound is serious, complete the treatment.

Suture of Tendons.—A recently divided tendon should be sutured with fine chromic catgut (No. 0 or 1). Some surgeons prefer fine silk, believing that the catgut makes a rougher suture and may be absorbed before the ends of the tendon have firmly united. The sheath should then be sutured with plain catgut. The skin wound should be closed entirely, or with drainage if infection is feared, and the part bandaged in such a position that the sutured tendon shall be relaxed. It is well to begin passive motions in a week or ten days, to prevent adhesions between the tendon and its sheath. Active motions, very gentle at first, should be begun within two weeks of the suture.

If the ends of the tendon come together without tension a simple stitch will suffice (Fig. 150 *B*). If the proximal part has retracted so that the stitch is likely to be pulled upon, a mattress stitch is better, as less likely to cut out (Fig. 150 *A*). Both stitches should be passed with a fine needle about one-quarter of an inch from the cut end of the tendon. If the gap between the ends is too great to permit of direct suture, one or both ends of the tendon may be elongated, as shown in Figure 151. This method is at best a clumsy one, and as it necessitates splitting the tendon sheath for a considerable distance, operators have been searching for a better method.

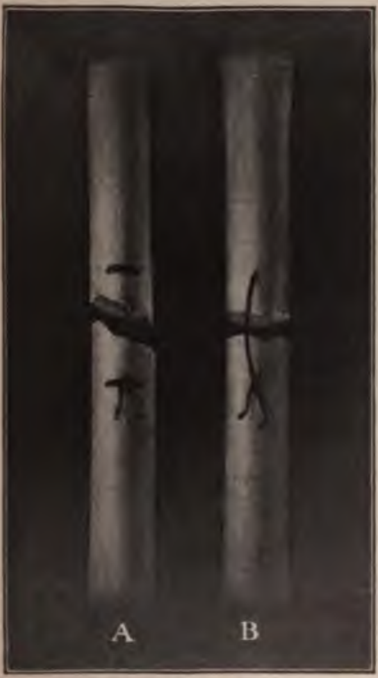

FIG. 150.—TENDON SUTURE. *A*, Mattress stitch ; *B*, simple stitch, more likely to cut out than a mattress stitch.

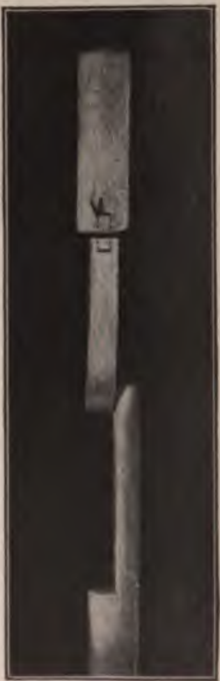

FIG. 151.—TENDON SUTURE. One method of elongation to fill a gap between the ends. There are many other methods.

Another way of overcoming a gap in a tendon due to retraction, or due to sloughing of the tendon from suppuration in its sheath, is to unite the separated ends by a long silk stitch, making no attempt to bring the ends of the tendon together, but leaving the thread to act as a part of the tendon (Fig. 152). The silk, like all aseptic foreign bodies of small size, becomes encased with fibrous tissue, and if the patient persists in passive and active motions as soon as the skin has healed, more or less use of an otherwise totally helpless finger will result. The reports in the few cases in which this method has been tried indicate that it is far superior to the splitting and elongation of the tendon itself. It is easy to split a recently divided tendon, but in the course of weeks or months the ends often atrophy so that there is is scarcely enough left to be recognized. On the other hand, nature is capable of filling a gap in a tendon if the sheath has not been closed by inflammation and if the ends are not constantly pulled apart by muscular action.

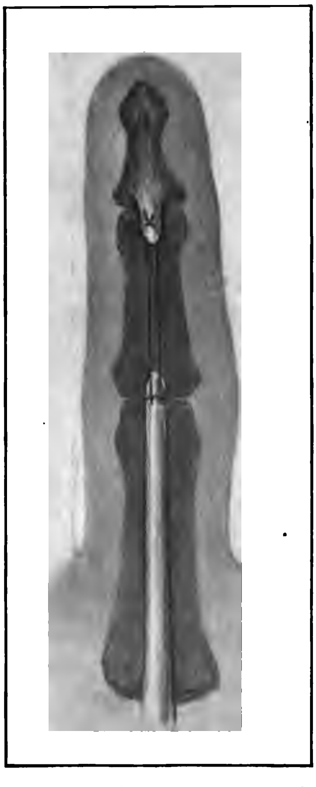

FIG. 152.—TENDON SUTURE. A long silk stitch left in place to act as a tendon. It becomes covered with fibrous tissue growing out from the cut ends of the tendon.

Suture of Nerves.—If a nerve is divided in a recent wound it should be at once sutured with very fine catgut or with silk. Three or four simple sutures should be inserted in the sheath of the nerve (Fig. 153). The skin should be sutured and the arm kept for two or three weeks in such a position that the nerve is relaxed. Motions should then be gradually resumed. It takes from three to nine months to restore function in a divided nerve. Sensation is usually restored before motion. During this period the condition of the muscles supplied by the nerve should be kept good by massage and electricity.

If the division of a nerve is an old one, its fibers have probably so degenerated that repair is out of the question.

If the divided nerve has retracted, or if a part of it has been destroyed, it may be split and turned down. The operation is similar to that upon a tendon (Fig. 151). This operation is still in the experimental stage.

If a nerve is injured by a blow, or by continued pressure, loss of sensation and of motion may follow. If the paralysis is total, and shows no signs of disappearing in a few days, the essential part of the nerve is probably divided. If so, the reaction of degeneration in the muscles supplied by it will appear in about fourteen days. The nerve should be exposed, ragged ends trimmed off, and sutures inserted. A contusion of a nerve may give a partial or complete paralysis, but its activity will gradually return, until after some weeks or months there is a complete restoration of function. This should be aided by exercise, massage, and electricity. This accident frequently follows prolonged anesthesia if the patient's arm is allowed to rest on the edge of the table (musculospiral), or if the arms are too tightly held over the head (brachial plexus).

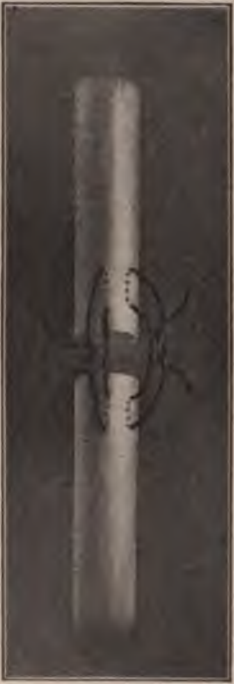

FIG. 153.—SUTURE OF NERVE. The needle should be passed through the sheath only.

Wounds of Joints.—A punctured or incised wound may open a joint. This accident is very important because of the infection which may follow, and may destroy the function of the joint. Under such circumstances the opening in the joint capsule should not be sutured entirely, but enough space should be left for drainage. The skin suture should allow a small wick of rubber tissue to extend to the opening in the capsule. Either a dry or wet dressing may be used.

If manifest impurities have entered the joint the opening in it should be so enlarged that free irrigation with sterile normal saline solution is possible. The drain of rubber tissue should in this case extend *through* the capsule of the joint. This drain should be withdrawn from the joint in twenty-four hours if there are no signs of increasing inflammation. A wet dressing should be employed.

In both classes of cases the joint should be immobilized by a splint applied, when possible, to the opposite side of the limb. The drain through the skin should be left in place two or more days, until it is evident that no more fluid is coming from the joint.

If the joint suppurates, the treatment is that given on page 425.

Foreign Bodies.—Splinters of wood, bits of glass, and parts of needles are the objects commonly found in wounds of the hand and arm. Bullets and shot are less common.

There is a popular belief that certain objects are especially likely to produce a suppurating wound. Brass filings and the slivers of yellow pine have this bad reputation. The former are often covered with grease or oil. The latter, on account of their strength and sharpness, penetrate more deeply than the ordinary splinter. Splinters usually lie obliquely. A small deeply placed splinter of new wood may become encysted like a piece of glass, and give the same symptoms.

Fragments of glass are often left in an incised wound because the physician is careless in inspecting so clean a wound, or because the transparent glass is not easily seen. Such wounds do not usually suppurate, and they often heal primarily. If a bit of glass is left in the wound it becomes surrounded by scar tissue, and may not be noticed until the main scar has atrophied. Then it is revealed as a hard object in or beneath the skin, giving a slight sharp pain when pressed upon or when certain motions are made. If the examiner cannot feel the foreign body distinctly, and if he does not cause pain every time he makes a certain pressure, he will do well to postpone operation until more definite symptoms are present or until a radiograph shows the exact situation of the object. Sometimes a patient, feeling pain in a scar, attributes it to the presence of a foreign body, although it is really due to pressure of the scar upon some nerve-fibers.

A needle is often driven into the hand or forearm while the patient is scrubbing, or dusting a curtain. The needle is broken, and the doctor is consulted if it breaks below the surface of the skin. Sometimes the end is in plain sight, or it can be felt just beneath the skin. Those cases are more difficult in which the patient received a punctured wound supposed to be due to a needle, although no needle was seen. There is pain on making certain motions, and pressure causes pain. These symptoms indicate that a fragment of needle, perhaps less than half an inch long, is buried in the tissues. A search for it without more definite knowledge of its situation is rarely successful. One should resort to a fluoroscopic examination or, better still, radiographs should be taken in two planes.

Bullets and shot may be touched with a probe passed through the wound of entrance and so diagnosticated. If this is not possible they should be located by means of the X-ray.

The fate of a foreign body embedded in the tissues depends partly upon its nature and partly upon the entrance with it of pathogenic organisms. Most foreign bodies are capable of resisting disintegration in the tissues for an indefinite time. They will, therefore, either become encysted or produce a suppuration and a sinus, through which, sooner or later, they will be expelled from the body. Powder grains and the ink of the tattooer are familiar examples of the first class. Needles and splinters of glass, being practically free from germs, are frequently included in an aseptic scar. Splinters of rotten wood, fish-bones, greasy metal filings, etc., are almost always cast out by the suppuration.

Treatment.—The treatment in all these cases should be to enlarge the wound of entrance sufficiently to render certain the removal of the foreign body and to provide for drainage. The skin, if grimy, and the wound should be thoroughly scrubbed with soap, turpentine, and ether. In cleaner cases, soap and hot water, followed by alcohol or an antiseptic solution, will suffice. It is well to reduce the pain as much as possible by the use of a local anesthetic. A splinter usually enters the skin obliquely; therefore the incision should be so made as to expose the whole splinter, in case the wood is rotten. With new wood a short incision may suffice.

If the wound has been caused by glass, its edges should be fully retracted, so that no portions of the glass shall be overlooked. These wounds are often oblique, or even irregular, due to the contraction of the muscles at the time the accident occurs. Hence there is a greater necessity for a thorough exposure, even though the wound in the skin has to be made larger.

A portion of a needle is often a difficult foreign body to locate. If the needle appears in the wound, it can be grasped with forceps and extracted. If one end of the fragment is felt just beneath the skin, its removal is likewise simple. In many cases, however, it can neither be seen nor felt by the doctor, although the patient is certain of its presence. In these cases plenty of time should be given to determine the exact location of the needle before the search for it is made with a knife. The best single guide to its position is the sensation of the patient when pressure is made upon the tissues in which the needle is embedded. The operator should make the most of this before administering a general anesthetic. Even after a local anesthetic this sensation may be lost. Incision for search has to be made in the long axis of the limb, and yet it is desirable to so direct the plane of incision, if possible, that the needle shall lie across it.

A bullet is often more readily reached through an incision made somewhere else than at the wound of entrance.

The decision to suture the wound, or to drain it, must rest upon the probability of infection. In doubtful cases it is well to suture the wound and to drain it with flat gutta-percha drains, which can readily be extracted in a few days, if there is then no sign of suppuration. In this manner the healing of the wound is scarcely interfered with.

If there is a possibility that all of the foreign material has not been removed, a drain should be employed to facilitate the casting out of small fragments or the extraction of larger ones.

Sprain.—A sprain is an injury of the joint caused either by a too great strain upon some ligament or by crowding together the bones of the joint. It will be seen, therefore, that the lesions produced may be either a rupture of some of the ligamentous fibers or a separation of the same from their bony attachments; or, on the other hand, a contusion of the cartilaginous end of one or both bones. Often these different lesions are associated. They can usually be differentiated by carefully pressing the ends of the bones together and by drawing them apart, and by overflexing and overextending the joint. If the bones are contused, pain will be excited when they are pressed together. If the ligamentous fibers are broken, or have been pulled from the bone to which they were attached, pain will be excited when the ligament of which they are a part is put upon the stretch. Besides these symptoms, there will be noted a certain amount of swelling, disability, and pain without manipulation according to the severity of the injury. There is sometimes effusion of serum or blood into the overlying soft parts; but in general the ecchymosis caused by a sprain is far less than that caused by a fracture. There is often a considerable effusion of serum into the cavity of the joint, increasing the swelling, and giving rise to fluctuation if the capsule of the joint is accessible to palpation (Fig. 154).

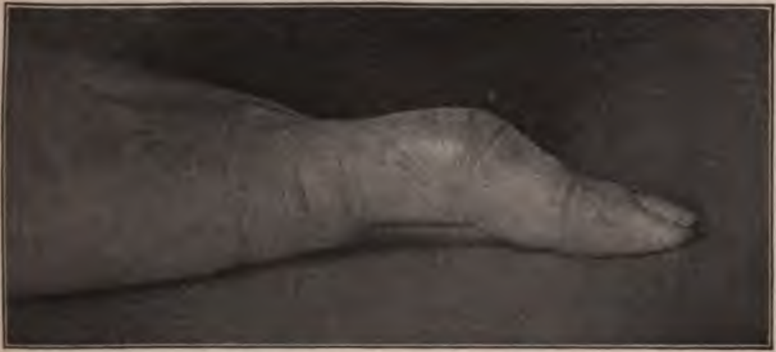

FIG. 154.—SPRAIN OF FINGER WITH SEROUS EFFUSION IN JOINT.

TREATMENT.—The treatment of a sprain is threefold: To prevent strain upon the injured ligaments; to facilitate the absorption of the exudate; to prevent adhesions and stiffness of the joint. The first indication is met by a splint which shall hold the joint in a position most comfortable for the patient. Such a position is usually between flexion and extension. The second object of treatment is accomplished by massage and passive motion. Light rubbing of the joint should be begun either immediately or after a day or two, according to the severity of the lesion. Passive motion is next in order of application. Active motion should be delayed in severe cases for a few days in order to give the acute symptoms time to subside. It is, however, the best means at our command to prevent adhesions in a joint.

A dressing which fulfils very well the first and second indications and allows active motions to a safe limited extent consists

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of strips of rubber plaster from half an inch to an inch in width, put on alternately from right to left and from left to right, so that they shall cross each other at nearly a right angle. In this manner irregularities in outline of the part may be smoothly covered (Fig. 155). If the wrist joint or one of the interphalangeal joints is sprained, the strip of plaster may be wound directly around the part.

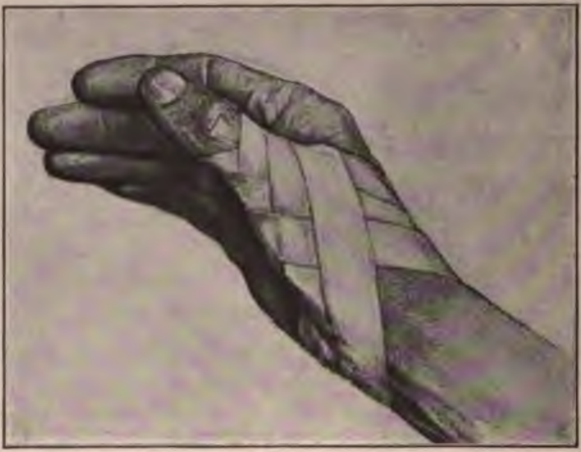

FIG. 155.—ADHESIVE PLASTER STRAPPING FOR SPRAIN OF THE METACARPO-PHALANGEAL JOINT. Drawn from a photograph.

If this dressing causes venous congestion, it may be slit longitudinally on the side opposite the sprain. In case of the larger joints it is only necessary to apply the strips through two-thirds of the circumference of the limb.

Sprain of the Shoulder (*Subdeltoid Bursitis*).—A common injury of the shoulder is partly a contusion, partly a sprain. It follows falls either upon the hand or upon the shoulder itself, and sometimes the effects of exposure are added to those of the traumatism. This condition of the shoulder is in some cases associated with neuritis, and in others is accompanied by a paralysis due to overstretching or pressure upon some part of the brachial plexus or of the circumflex nerve. Paralysis of the affected muscles then becomes a prominent symptom.

Anatomically it is to be noticed that the shoulder is more thoroughly covered with muscular tissue than any other joint in the body. The large muscles about the hip-joint do not overlie the great trochanter, and are therefore not likely to be injured by direct falls upon the hip; while the joint itself is so firm that sprains are not likely to follow indirect violence. On the other hand, lax joints, such as the wrist, are constantly exposed to violence, both by direct blow and by sudden overstretching, but there is no muscular tissue in the vicinity to be injured. The shoulder-joint then is peculiar in its muscular covering; and while the joint itself is so freely movable that it is not likely to suffer from overstretching, the muscular and fibrous planes and bursæ and nerves about it are exposed to injury either from overstretching or from a direct blow.

DIAGNOSIS.—A patient who has injured his shoulder by falling on the hand, or on the shoulder itself, either presents himself within a day or two after the accident on account of the pain and disability, or else he seeks advice in a week or two because improvement under home remedies has been so slow that he fears that the injury is more serious than he at first supposed.

Examination of the shoulder after all clothing has been removed from both shoulders and arms shows an absence of bony deformity; and only a slight swelling over the head of the humerus anteriorly and exteriorly. Direct pressure is not painful, nor is pressure made upon the elbow in such a manner as to crowd the head of the humerus against the scapula. Both active and passive motions are limited by pain, and usually to about the same extent. Internal rotation is not very painful, and the patient can often put his hand behind his back. External rotation and abduction cause pain in the anterior portion of the deltoid muscle. If the elbow is fixed at the side and the forearm flexed at a right angle, the patient may be able to rotate the arm outward sufficiently to bring the hand directly forward, though even this is usually quite painful. If asked to abduct the arm, the patient raises the scapula and humerus together, not changing the angle between them. He cannot usually raise his hand as high as the top of his head. When the elbow is at the side it can be pushed backward with far less pain than it can be pushed forward. In other words, the lesion seems to be located in the anterior portion of the deltoid muscle, or immediately beneath it, since contraction of this muscle or passive motion of the arm made in such a manner as to stretch it over the head of the bone causes pain. Other signs of inflammation are wanting.

If two weeks or more have elapsed since the accident, there will be noticed the additional symptom of atrophy of the deltoid, apparently from disuse, and the humerus will stand out more prominently on the affected side, so that without a careful examination one might think some bony deformity was present. Such an accident occurring to a patient who is a regular whisky drinker is usually sufficient to produce a neuritis of the circumflex nerve.

Neuritis of the shoulder or arm, whether alcoholic or otherwise, may occur without traumatism. The pain then exists when the limb is at rest as well as when it is moved. The pain, too, will probably not be limited to so small an area. Acute articular rheumatism, gonorrheal arthritis, suppurative arthritis, tuberculosis, and syphilis of this joint all have such marked symptoms due to temporary or permanent derangement of the joint that they can hardly be mistaken for simple sprain.

The effects of sprain last for some weeks or months, and in the alcoholic, " rheumatic," old, and neglected, complete use of the joint may never be regained.

TREATMENT.—The best treatment for sprain of the shoulder is bathing the shoulder twice a day with very hot water, following this with vigorous rubbing. Two or three times a week the surgeon or some other responsible person should perform abduction and external rotation of the arm, as fully as the patient can bear it, to prevent permanent limitation of motion. The patient himself should make full active motions of the joint several times a day. Counter-irritation may be required to allay pain.

Neuritis.—Neuritis of the arm occurs spontaneously, or from exposure to cold, or as a complication of sprain and other injuries. Long rides in automobiles is a fruitful cause of neuritis, especially in those unaccustomed to severe muscular exercise. If the history of the attack is confusing a differential diagnosis can usually be made by the existence of pain along the nerve trunks and their branches, when the arm is at rest as well as when it is moved. Sometimes paralysis, complete or partial, is the striking symptom. This is the case when the brachial plexus is injured by too violent attempts to reduce a dislocation of the shoulder; or by prolonged elevation of the arms above the head in sleep or anesthesia; or when the musculospiral is caught and pressed upon by the callus in fracture of the shaft of the humerus.

The local treatment of neuritis consists in the application of heat or cold or counter-irritants to relieve pain and improve local circulation, with rest of the affected parts. Later bathing, massage, and electricity are beneficial, and still later active motion. It is in these cases that the daily use of a mechanical vibrator proves very satisfactory. If there is continued pressure upon the nerve, as from a broken bone or callus, this should be removed early. If there is reason to think that the nerve may have been ruptured, it should be exposed for suture. In most cases occasional passive motions should be made from the first, to prevent the formation of adhesions, limiting the free motions of the joints.

Acute Non-suppurative Tenosynovitis.—This cumbersome title is used to indicate a condition which a traumatism may produce in any tendon sheath, but which is most common in those of the extensor tendons of the thumb and radial side of the hand. It is marked by tenderness and swelling, and a peculiar fine crepitus or creaking which is due apparently to a loss of polish of the tendons and inner lining of the synovial sheaths, especially where they lie close to the radius about two inches above the plane of the joint (Fig. 156). The slightest motion of the

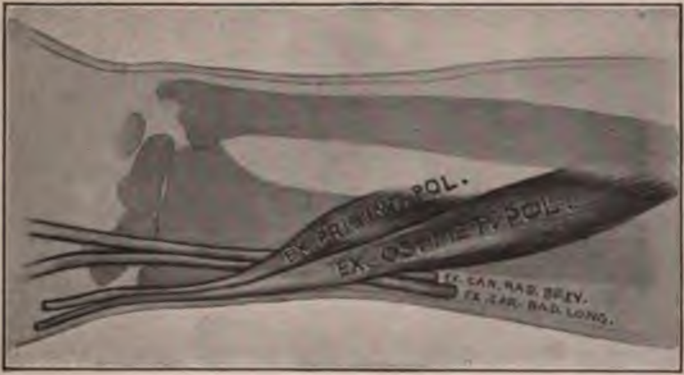

FIG. 156.—DIAGRAM OF THE BACK OF THE RIGHT WRIST TO SHOW THE RELATIONS OF THE TENDONS TO THE RADIUS AND TO ONE ANOTHER. Note that the tendons of the extensor carpi radialis longus and brevis lie between the tendons of the extensors of the thumb and the shaft of the radius. When in violent action each pair saws on the other, and also on the bone.

thumb or hand, whether active or passive, will produce this creaking.

The history given by the patient is almost invariably as follows: After a period of comparative idleness, he went to work at moving furniture or polishing wood or some occupation requiring equally severe muscular effort. Next day his arm was sore, but he kept on working until the pain compelled him to stop. This crepitus may persist for five days or a week after work has been given up, although if the hand is kept absolutely at rest on a splint, it usually disappears in a day or two. In slight cases it may wear off in a few minutes—during the diagnostic manipulation by a class of students, for example. In some workshops this tenosynovitis is of common occurrence among the new men employed.

While the above mentioned cases represent the usual type of tenosynovitis, the writer has known this lesion to be produced in the sheath of the extensor tendon of the index-finger, the corresponding metacarpal bone having been fractured some weeks previously, and the patient having returned to work while there was still a sharp projection posteriorly at the site of fracture, due partly to displacement and partly to callus. Pulling the extensor tendon backward and forward over this bony prominence set up the dry tenosynovitis.

TREATMENT.—The treatment of these cases is comprised in two words rest and counter-irritation, the former of which is far more important, while the latter will relieve the acute pain which exists in the first few days. A light splint, compound iodine ointment, and a gauze or starch bandage make up the dressing which should be left in place for four or five days. If symptoms persist, the dressing should be repeated. The patient should be advised to begin very gradually to use the hand.

Serous Synovitis.—The joints of the upper extremity are not so prone to fill with fluid after a traumatism as are the joints of the lower extremity. Still such serous effusions occur. Figure 157 shows distention of the right shoulder-joint following an unrecognized dislocation. Six ounces of the fluid which was slightly bloody, was aspirated. Note the flattening of the outline of the shoulder which resulted from the aspiration (Fig. 158).

Fluid in the elbow-joint distends the arm posteriorly on either side of the olecranon. A small amount of fluid will give fluctuation.

Injuries of the joints of the wrist and fingers usually cause so much swelling of the overlying skin and subcutaneous tissue that the outline due to fluid in the joint is obscured. In a chronic synovitis the fluid

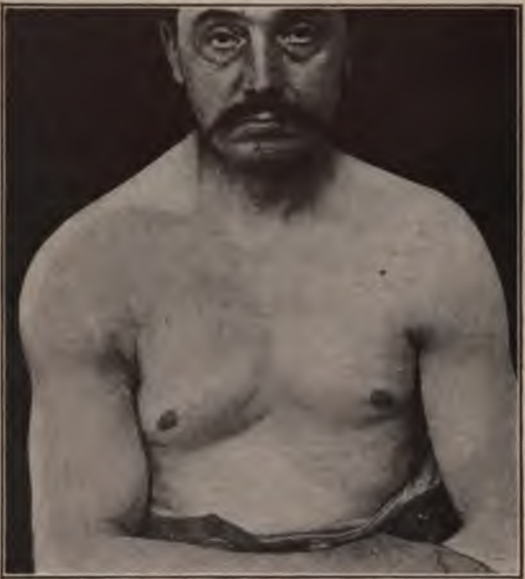

Fig. 157.—Effusion of Bloody Serum into the Right Shoulder-joint in Dislocation, with Frequent Manipulation.

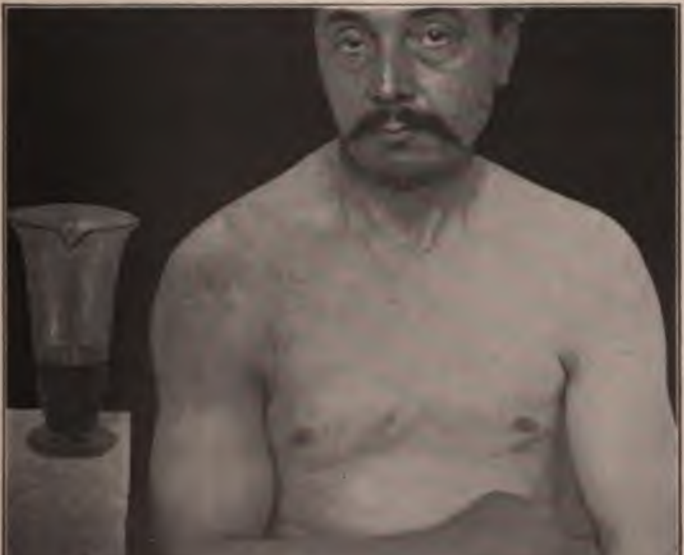

Fig. 158.—Right Shoulder after Aspiration of Six Ounces of Bloody Serum. Same subject as Fig. 157.

in the joint is readily recognized. It is generally of a tubercular character (p. 440).

The treatment of serous synovitis is that of the injury, of which the effusion is only a symptom. The amount of fluid will rarely be so great as to require aspiration.

Bursitis.—The olecranon bursa may fill with serum as the result of a single severe blow or after repeated slight traumatisms (miner's elbow). It forms a smooth, tense, somewhat tender, fluctuating tumor between the skin and the olecranon process. If the skin is broken by the injury, the bursa is likely to become infected, and then redness and edema of the skin will be added, and the tenderness will be greatly increased. If the bursa is punctured there will be a discharge of thin mucous or purulent fluid. For infected bursitis see page 427.

Other bursæ of the arm are rarely affected by an injury.

TREATMENT.—The treatment of an uncomplicated case of olecranon bursitis consists in rest to the joint and pressure, with wet dressings if the skin is abraded. In a later stage of the trouble, counter-irritation, then aspiration and pressure, may be tried. If these measures fail, the bursa may be opened longitudinally, and its cavity drained with gauze, so that it will heal by granulations. A better plan is to dissect out the bursa and suture the wound. This requires a general anesthetic, and takes longer, but it does away with a tedious period of recovery. (Compare the paragraphs on diagnosis and treatment of the prepatellar bursa.)

CHAPTER XIV

DISLOCATIONS AND FRACTURES OF THE ARM AND HAND

DISLOCATIONS

The records of a large hospital for a period of years show that two-thirds of the dislocations treated there involved the shoulder-joint, and that three-fourths of all dislocations treated were of some joint of the arm or hand.

A dislocation of a joint is an injury by which one of the articulating bones has been pushed out of its normal relation to the other. The dislocation may be partial or complete. It may be reduced spontaneously at the time of injury, in which case only the symptoms of a sprain will persist. In other cases reduction is easily accomplished; while in still others it is difficult, and may even be impossible without an operation.

The symptoms of dislocation are those of a sprain of the joint, viz., pain, swelling, tenderness, and possibly ecchymosis, and in addition marked deformity, and great limitation of motion. But these last named symptoms, which are so characteristic in many cases, may in others be obscured by the swelling. Axial deviation of the bones is another symptom which is often of great diagnostic value.

General Remarks on Treatment.—There are two general methods of reducing a dislocated bone. One is to make traction until the distal bone slips into its true relation to the proximal bone. The other plan is to swing the lower end of the distal bone toward the side on which it is displaced; for example, flexion in case of an anterior dislocation of the finger, overextension in case of a backward dislocation.

Reduction is interfered with by muscular contraction, by the irregular shape of the bones, by intervening ligaments or other tissues.

Muscular contraction may be overcome by an anesthetic or by long continued traction in such a manner as to tire out the muscles or by dexterity on the part of the surgeon, so that manipulation is made when the patient's attention is distracted, and his muscles are off their guard. The various motions made for reduction should never be violent nor powerful. That which one can accomplish with great force can almost always be accomplished with little force if properly directed for a sufficient time; and permanent injury is likely to follow the use of violence.

Manipulation of the bones at the joint, while an assistant makes traction at a distance, will favor reduction by guiding one bone past the other, and through the rent in the capsule if the bone has protruded. Such action may well be compared to drawing a shoe-button through the buttonhole by means of a buttonhook.

If all other measures fail to reduce a dislocation, an incision should be made for this purpose. The risk of infection and a subsequent stiff joint is not great when the operation is properly performed. It is better to assume this risk than to suffer the permanent disablement of an unreduced dislocation.

A common mistake is to give too favorable a prognosis after a dislocation has been satisfactorily reduced. Except in cases in which the capsule of a joint is abnormally loose, the bones cannot be dislocated without producing at least as much injury to the surrounding parts as exists in a severe sprain. While such injury is many times perfectly recovered from, the convalescence may be most tedious, and in many cases the functions of the joint are never fully regained. This is especially true if the interval between dislocation and reduction is a long one.

The question is sometimes asked, How long after the occurrence of a dislocation is it possible to replace the bone? No definite answer can be given. My own experience tends to show that manipulation is rarely successful if the interval is more than four weeks. Furthermore, if a reduction is then accomplished, it is less complete than when accomplished promptly, and extra precautions are needed to keep the bone in place. Before attempting to replace the bone, the surgeon should move it about in all directions, to break up adhesions, overcome stiffness of the muscles,

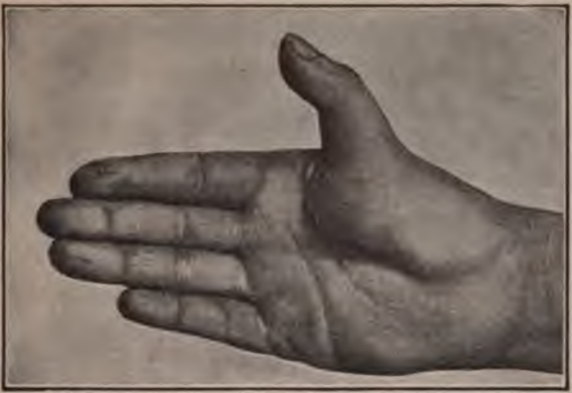

FIG. 159.—DISLOCATION OF THE THUMB OF SEVEN YEARS' DURATION. Patient a boy aged twelve years.

and so to gain as much freedom of motion as possible. Not until this has been done should the specific motions of reduction be per-

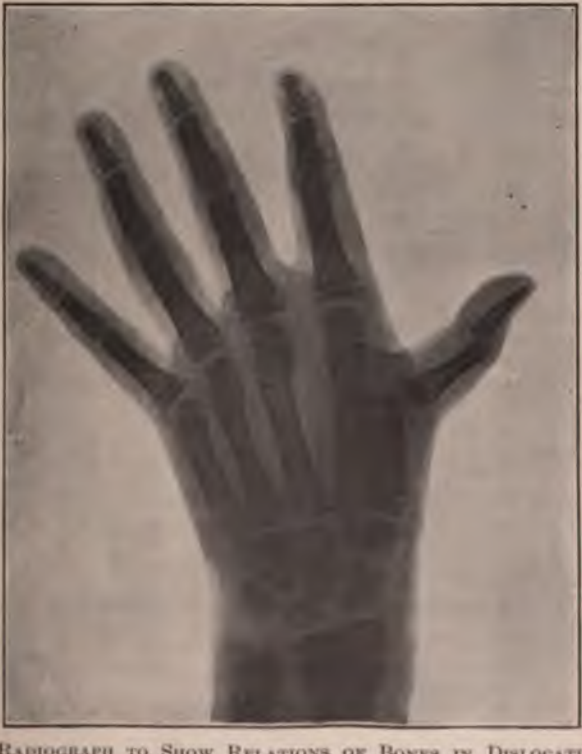

FIG. 160.—RADIOGRAPH TO SHOW RELATIONS OF BONES IN DISLOCATION OF THE THUMB OF SEVEN YEARS' DURATION. Same subject as Fig. 159. Note the formation of a new bony articulation on the back of the metacarpal.

formed. In these late cases a general anesthetic is absolutely indicated.

The condition of an unreduced dislocation improves somewhat as months go by. The ends of the bones form imperfect sockets for themselves, so that the functions of the joint are partially restored, but its use is more or less painful. The deformity is of course permanent. These points are strikingly illustrated in Figures 159 and 160. The radiograph shows both the bony outlines and the contour of the dislocated thumb. In this case subsequent growth of the bones has increased their abnormality.

By operation in a case of long standing dislocation one may reasonably hope to secure a correct alinement of the bones and some improvement of function with less pain. A normal joint may be hoped for, but should never be promised. The ultimate success depends not a little upon the faithful performance of active and passive motions of the joint, massage, and hot bathing.

Dislocations of the Shoulder.—The humerus may be dislocated upon the scapula in any direction excepting upward. An upward dislocation can only take place if the acromion process is broken off, and this accident rarely happens. The form of dislocation which exists in more than ninety-five per cent of the cases is downward and forward beneath the coracoid process. The injury is usually produced by a fall on the outstretched arm or hand. The capsule of the joint is torn anteriorly in its lower part.

The signs peculiar to dislocation of the humerus are absence of the head of the bone from its socket, flattening of the shoulder, projection of the elbow, and the impossibility of bringing it to the side of the body, and most important of all, the presence of the head of the bone in an abnormal situation, usually below the coracoid process. There is also a difference in the length of the two arms, measured from the tip of the acromion to the external condyle of the humerus. There is a shortening on the affected side, which is increased by abduction of the arm.

TREATMENT.—Reduction of the bone by a direct pull upon the arm is a difficult procedure, often requiring great force, and exposing the patient to injury of the axillary vessels or nerves; but a long continued, slight pull will often accomplish the end in view without great pain and without serious risk. Stimson carries this out by allowing the patient to lie upon a high canvas cot, with his arm hanging through a hole in the canvas. To his wrist is attached a two pound weight. The traction will gradually overcome the muscles and will bring the head of the bone back into position in less than ten minutes.

The usual method of reducing a dislocated humerus is to place the patient upon his back on a firm table; to flex, extend, abduct, and rotate the humerus for several minutes, in order to break up adhesions, and to partially tire out the muscles. The next step is to flex the forearm on the arm, and to forcibly rotate the latter outward for two or three minutes until the muscles yield to the steady tension. With the arm still rotated, the elbow is carried upward across the chest, and as the head of the bone slips into its socket, the hand is brought over to the opposite shoulder, and fixed there by a strap of adhesive plaster or a bandage. This simple manipulation, known as Kocher's method, will usually succeed in reducing a fresh dislocation. It can be performed either with or without an anesthetic.

In other cases *inward* rotation of the arm, followed by a sudden hitch outward of the upper arm, will throw the head of the bone back into place.

When the dislocation has been reduced the arm should be kept in a sling, but it need not be firmly bandaged to the body unless the patient is very untrustworthy. Such close confinement tends toward stiffness of the shoulder, and this should be avoided when possible. The shoulder should therefore be bathed and massaged daily, and slight passive and active motions allowed (see treatment of sprain, p. 339). The elbow should not be raised to the level of the shoulder for two or three weeks, lest the dislocation be reproduced.

Dislocations of the Elbow.—Dislocation of the elbow is not a common accident, for the reason that the ulna is so closely articulated with the humerus that an injury is more likely to break the lower part of the humerus than it is to produce a dislocation.

The head of the radius may be dislocated either backward or forward (Fig. 161) or to one side.

The commonest form of elbow dislocation is the backward dislocation of both radius and ulna (Fig. 162), with or without fracture of the coronoid process. If no fracture exists, the dislocation is of necessity an extreme one, since the coronoid process is carried behind the articular surface of the humerus. This produces a deformity which should not be overlooked. The tendon of the triceps is tightened when an attempt is made to flex the forearm; and the whole olecranon portion of the ulna is posterior to the condyles of the humerus when the forearm is at right angle with the arm. Normal motions of the joint are considerably limited. The head of the radius, recognized by palpation and rotation of the wrist, may be felt to the outer side of the olecranon. In case the ulna alone is dislocated, the head of the radius will remain in its natural position. The dislocation of the forearm in this case will not be directly backward, but the forearm will swing round upon the head of the radius as a pivot, so that if the forearm is held at right angles with the arm in the position of supination, the hand will be considerably nearer the median line of the body than it ought to be. If the radius is dislocated with the ulna the forearm may be carried directly backward, or it may be more or less laterally displaced. In every case of dislocation or other injury about the elbow, it is of the greatest importance to determine the relations of the two condyles of the humerus, the tip of the olecranon and the head of the radius.

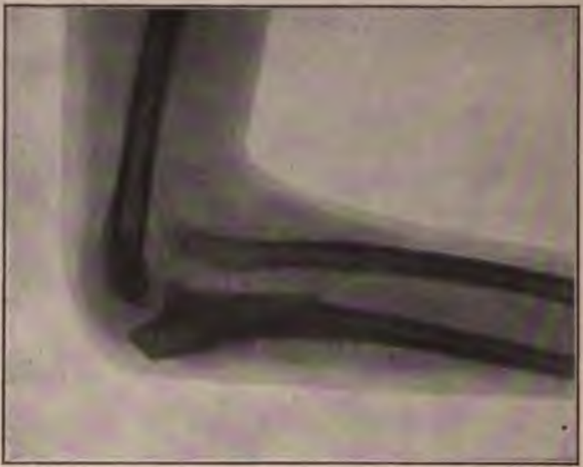

FIG. 161.—RADIOGRAPH OF FORWARD DISLOCATION OF THE HEAD OF THE RADIUS, FIVE MONTHS' DURATION, AND FRACTURE OF THE ULNA OF THREE WEEKS' DURATION. Patient a girl aged seven years.

Dislocation at the elbow is often combined with fracture of some bone. In this case the characteristic signs will be more or less obscured. Indeed, injuries of the elbow-joint afford some of the most difficult diagnoses, and the surgeon should not miss the aid offered by radiographs made in the anteroposterior and bilateral directions.

TREATMENT.—Backward dislocation of the elbow-joint, if of recent occurrence, can usually be reduced without difficulty. The patient should be fully anesthetized. The range of motion of the forearm on the arm is then to be increased by repeated gentle manipulation in all directions, and then, while an assistant fixes the upper arm, the surgeon makes an attempt to unlock the ulna from the humerus and bring it forward. Sometimes this is easily accomplished; sometimes a number of efforts must be made before success is obtained. As in all dislocations, strategy rather than great force should be employed. It is sometimes possible to slide the ulna toward the inner side of the humerus, and then to bring it forward. When one bone has been reduced, or in case only one of the bones is dislocated, the bone which is in place acts as a lever to drag the other one into place if a firm lateral motion, either abduction or adduction, is combined with the forward traction upon the forearm.

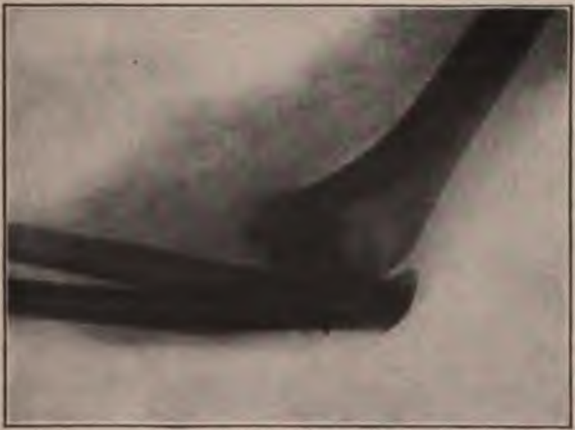

FIG. 162.—RADIOGRAPH SHOWING BACKWARD DISLOCATION OF BOTH RADIUS AND ULNA OF FIVE MONTHS' DURATION. Patient a man aged fifty-eight. An operation was necessary to reduce this dislocation.

It is said that reduction by manipulation is rarely possible in dislocation of the elbow-joint which has lasted a month or more. In every case the manipulation should first be tried, and tried most thoroughly, not only on account of the possibility that it may succeed, but because the added freedom of motion thereby obtained is of the greatest help to the operator in case he has to expose the bones through incisions. The best incisions to employ in this instance are two lateral ones, linear longitudinally when the forearm is extended, but more or less curved in the semiflexed position of an old dislocation.

When the elbow has been reduced by manipulation or operation, the forearm should be flexed to a right angle and kept so by a sling, or a gypsum bandage, or molded splints. As soon as possible passive motions and massage and hot bathing should be instituted. Such treatment should be begun within a week if a fresh dislocation has been reduced by manipulation, and as soon as the wounds will permit in cases reduced by an open operation. It is well to remember that oft-repeated slight motions have a far greater curative value than a few violent ones. For this reason active motions made by the patient himself are especially to be encouraged. He should be given certain definite motions to practise several times daily which will tend to increase the existing range of motion.

Subluxation of the Radius.—Dislocation downward of the head of the radius, or subluxation, as it has been called, may be produced in young children by jerking them or lifting them suddenly by one hand. The head of the radius is pulled downward out of the coronoid ligament, usually without other injury. Examination will show a certain amount of tenderness at the seat of injury and loss of function, especially in the matter of pronation and supination of the hand; but these signs are frequently obscured by the fact that a young child will refuse to make any motions of an injured joint through fear. Hence the symptoms elicited may differ in nowise from those of a sprain of the elbow. The only characteristic sign, therefore, is the absence of the head of the radius from its normal position, and its presence slightly below this point. Careful measurement from the external condyle of the humerus to the styloid process of the radius will show that the distance is slightly increased upon the injured side. A differential diagnosis between this injury and fracture of the neck of the radius can best be made by an X-ray examination.

TREATMENT.—This dislocation is easily reduced, either with or without an anesthetic. The upper arm should be grasped firmly near its lower end at the same time that the hand and lower end of the radius is also firmly held. The forearm should be extended, and the radius pushed steadily upward at the same time that it is rotated slightly to right and left. In this manner it can be slipped back into place much as a peg is worked into a hole.

Dislocation of the Wrist.—Dislocation of the wrist is a rare occurrence, owing to the fact that the lower end of the radius is broken by an injury which might otherwise cause a dislocation. The deformity, whether anterior or posterior, is extreme, resembling that of Colles's fracture with marked displacement of the lower fragment. Motion at the wrist-joint is greatly limited. The normal relation of the tips of radius and ulna is preserved, and measurements of these two bones will show them to be of normal length. After reduction of the dislocation the hand should be kept for two weeks or more upon an anterior splint.

Dislocation of the Thumb.—Dislocation of the carpometacarpal joint of the thumb occurs rarely. Fracture of the metacarpal bone is common. If the fracture is near the base it may be difficult to differentiate it from a dislocation without the use of the X-ray. Crepitus, a difference in measurements, and the impossibility in making a perfect reduction will indicate fracture; but in the presence of considerable swelling these signs may not be clearly obtained.

This dislocation is easily overcome by manipulation. Adhesive plaster strapping will prevent its recurrence (see Fig. 155, p. 340), or a starch bandage may be applied to the thumb and wrist.

The proximal phalanx of the thumb may be dislocated backward. The anterior portion of the capsule is torn from the metacarpal and the thumb rests upon the posterior surface of the metacarpal, sometimes forming an angle of ninety degrees with its shaft. It is evident that such a dislocation, if unreduced, will render the thumb nearly useless (Figs. 159 and 160, p. 349). This condition is easily recognized. A fracture may be followed by posterior displacement of the distal portion, but it does not give such an axial deviation as dislocation.

Treatment.—Reduction is sometimes made difficult by the interposition of the torn capsule or the outer sesamoid bone, or by the position of the head of the metacarpal between the two heads of the flexor brevis muscle. To avoid these hindrances the surgeon should first bring the metacarpal into the center of the palm so as to relax the flexor brevis muscle, should flex the distal phalanx to relax the flexor longus tendon, and should increase the dorsal flexion of the proximal phalanx and rotate the bone slightly from side to side in order to dislodge any structures which have intervened between the bones. The base of the phalanx is next to be pushed along the posterior surface of the metacarpal until it is partly beyond it. Not until then should flexion be attempted.

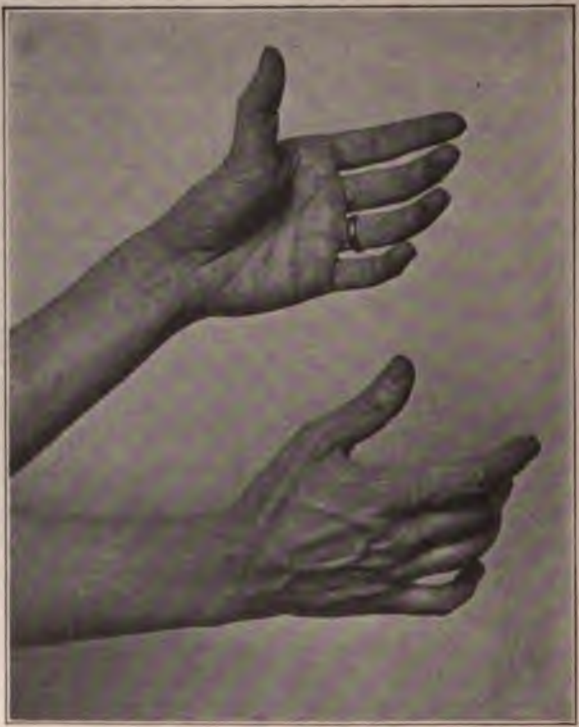

Fig. 163.—Full Extension of Adult Thumbs. Right thumb normal; left thumb abnormally overextended.

If reduction is not accomplished, the patient should be anesthetized, and another attempt at reduction should be made. If this is not completely successful, the joint should be exposed by a radial incision and normal relations established. Perfect restoration of function should follow. This operation should also be performed in cases of dislocation of long standing. Under such circumstances resection of the head of the metacarpal will usually be necessary. The results are then not as perfect, but the use of the thumb is far greater than if it is allowed to remain permanently displaced.

In either operation the wound may be closed at once or a horsehair drain may be used. This should extend only as far as the capsule of the joint and should be removed in forty-eight hours if there is no suppuration of the wound. The thumb should be bandaged in a slightly flexed position. If the joint suppurates it should be treated by drainage through the incision, and a wet dressing and a splint should be applied, as described on page 425.

Overextension of Thumb.—Overextension of the first phalanx of the thumb, simulating a dislocation, is possible in many persons. It is due to an abnormal laxity of the anterior ligaments, either the persistence of an infantile condition or the result of traumatism in childhood (Fig. 163).

Dislocation of a Finger.—Dislocation of the metacarpophalangeal joint of a finger may occur, but this is not common, on account of the strong ligaments; consequently fracture of the head of the metacarpal is the usual result of injury in this locality. A differential diagnosis between the two can usually be made by taking exact measurements and comparing them with those of the opposite hand. A pair of calipers is convenient for this purpose. A difference may also be observed in the knuckle when the fingers are flexed. In this position the

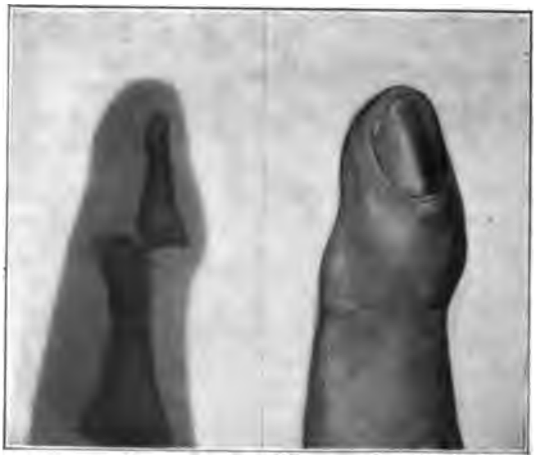

FIG. 164. POSTERIOR DISLOCATION OF THE TERMINAL PHALANX OF THE FOREFINGER, AND RADIOGRAPH OF THE SAME. Patient a man aged twenty-three years.

knuckle is wholly formed by the head of the metacarpal, and will not, therefore, be altered in a dislocation, whereas in fracture it will be less prominent.

Dislocation of one phalanx of the finger upon another may be anteroposterior (Fig. 164) or lateral (Figs. 166 and 167). The cause is usually a blow upon the finger-tip or a fall upon the outstretched hand. Sometimes the finger is caught between two moving hard surfaces, which, in the lateral dislocation here illustrated, were the teeth of a horse.

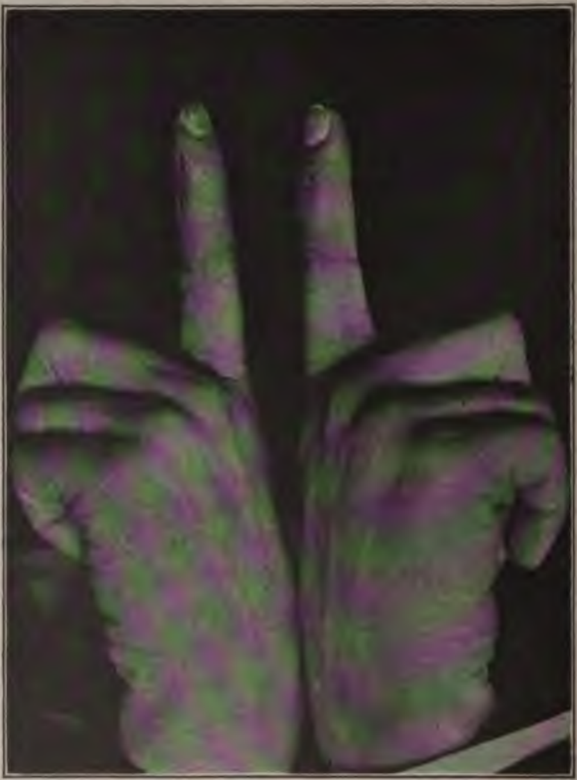

Fig. 165.—Reduction of Posterior Dislocation of the Terminal Phalanx of the Forefinger by Operation. Photograph two weeks later. Same patient as shown in Fig. 164.

The diagnosis of these dislocations is readily made unless there is great swelling. The eye can detect the error in the bony alinement, which cannot be corrected, while the range of motion of the joint will be distinctly limited.

If the dislocated bone is allowed to remain in its abnormal position the finger will not be entirely useless, but the range of motion of the affected joint will never be fully regained and the deformity will be permanent. Hence, treatment is indicated in most cases, even of an operative character, if reduction cannot otherwise be obtained.

TREATMENT.—Reduction of a partial dislocation is simple, and is usually accomplished by a bystander or by the patient himself. In some cases, however, torn ligaments intervene between the ends of the bones, making perfect reduction impossible. The reduction of a complete dislocation is more apt to be interfered with by the interposition of the ligaments, and the various pulls and twists of sympathetic friends will in such cases merely increase the traumatism and its resulting swelling.

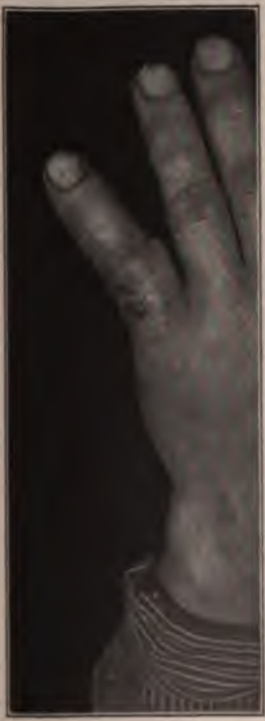

FIG. 166.—LATERAL DISLOCATION OF LITTLE FINGER DUE TO THE BITE OF A HORSE.

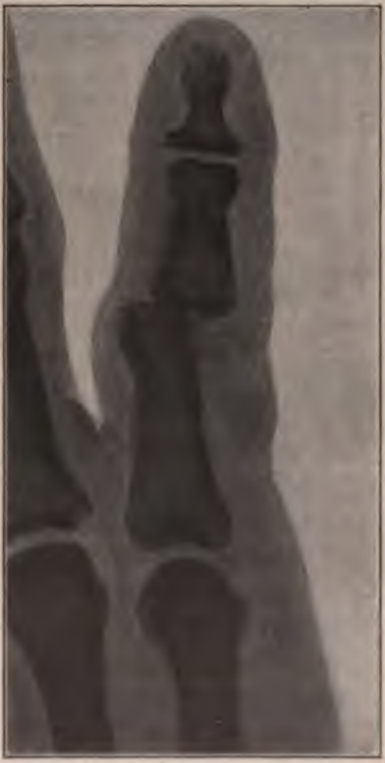

FIG. 167.—RADIOGRAPH OF LATERAL DISLOCATION OF LITTLE FINGER. Same patient as shown in Fig. 166.

As in all dislocations, the simplest measures should first be tried. Extension should first be made upon the distal portion at the same time that the dislocated bone is manipulated. If this fails, the axial deviation of the displaced distal bone should be exaggerated, and while traction is made upon it in this direction an attempt should be made to crowd its base past the head of the proximal bone. Unless this last effort is successful it is useless to swing the shaft of the bone into a correct line. If these efforts fail, continuous traction may be employed. A pound or two pound weight should be fastened to the finger by adhesive strips, and the hand allowed to hang vertically downward. If this method is not successful in fifteen or twenty minutes, it should be abandoned.

If all these methods fail, it is necessary to expose the joint by two lateral incisions, to remove intervening ligaments and new formed cicatricial tissue if the dislocation is an old one, and to pry the bones back into place. When this has been accomplished the wounds should be closed by suture with horsehair or fine black silk (Fig. 165).

Whatever the treatment, when the dislocation has been reduced it is not likely to return. It is only necessary to apply an anterior splint of wood to the finger, or its motions may simply be confined by strips of adhesive plaster wound about the finger spirally or circularly.

In any case in which a bone is used as a lever in manipulations the risk of fracture should be borne in mind.

If a dislocation remains unreduced for some weeks, fibrous tissue forms about the ends of the bones, so that reduction will be impossible without operation. The X-ray may show no trace of this tissue, but may give the impression that reduction will be very easy, as was the case in the patient whose finger is shown in Figures 166 and 167.

If the patient is a child, and the dislocation remains unreduced, continued growth will alter the shape of the bones, and may even establish a new joint, as shown in Figure 160, page 349.

Drop-finger.—A blow upon the end of the finger may rupture the posterior part of the capsule of the distal joint. As this part of the capsule is the extensor tendon of the finger spread out flat, it is impossible in such circumstances to extend the distal phalanx, which drops forward (Figs. 168 and 169). This deformity is known as drop-finger or mallet-finger or "base-ball-finger."

TREATMENT.—If seen at once and kept continuously in extension for two or three weeks by a light anterior splint, union of the tendon to the bone will often take place. If the deformity is neglected for some days the same treatment may be tried, but with less probability of success. If no union results after several weeks of treatment, an attempt should be made to sew the end of the tendon to the base of the last phalanx with fine silk. The incision should be a U-shaped one, the opening of the U directed upward, the base of the U crossing the finger about midway between the joint and the point where the skin is reflected to the nail. In turning this flap upward care should be taken not to disturb the bed of the nail. In such an operation the finest instruments are essential to success. In other cases the posterior part of the base of the phalanx is pulled off with the insertion

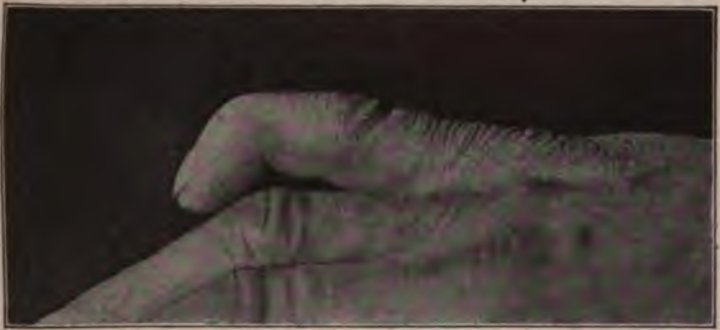

FIG. 168.—DROP-FINGER OR MALLET-FINGER. On account of rupture of the extensor tendon which forms the posterior ligament of the terminal joint, extension is impossible.

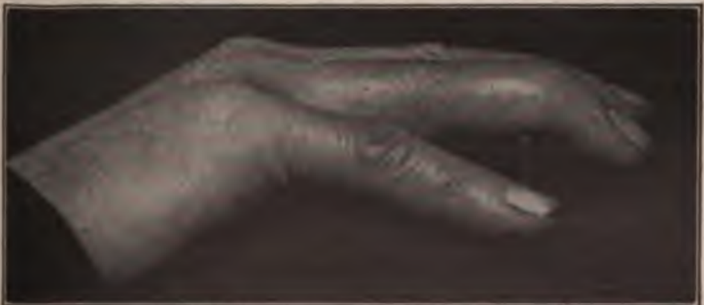

FIG. 169.—TRAUMATIC DROP-FINGER OF THREE MONTHS' DURATION. Patient aged sixty years.

of the tendon (Figs. 170 and 171). The "drop" of the tip of the finger is then less marked, but even when the finger is forcibly extended there will still be some deformity. Treatment by anterior splint will give a somewhat thickened finger with good function. In order to avoid deformity the loosened fragment of phalanx should be removed through a transverse incision. The periosteum should be saved if possible. This or the termination of the tendon should be stitched to the periosteum of the third phalanx or kept in place by pressure. An anterior splint should be worn for two weeks, and the patient should avoid complete flexion of the distal phalanx for some weeks more.

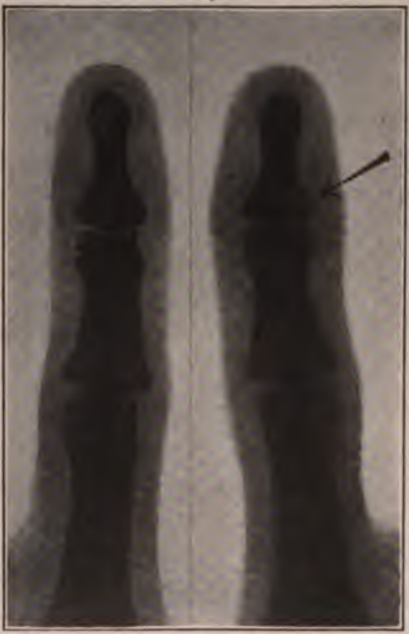

FIG. 170.—RADIOGRAPH OF TRAUMATIC DROP-FINGER, ANTERO-POSTERIOR VIEW. A portion of the terminal phalanx has been torn off with the posterior ligament.

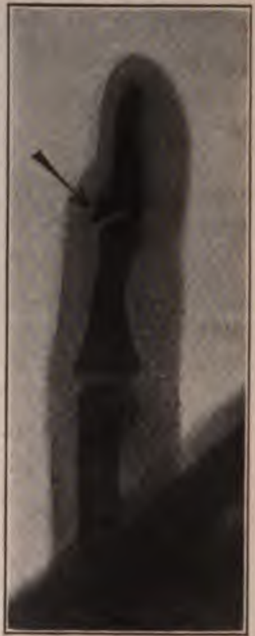

FIG. 171.—RADIOGRAPH OF TRAUMATIC DROP-FINGER, LATERAL VIEW. Same patient as Fig. 170.

In some cases the terminal phalanx of the finger is overextended and bent directly backward. The term "baseball-finger" is applied by some writers to this condition exclusively. It is the result of force suddenly applied to the tip of the finger and in most instances the permanent deformity is due to fracture of the terminal phalanx, and not simply to rupture of the anterior ligament.

FRACTURES

Fractures in General.—DIAGNOSIS.—The diagnostic points of a fracture are well known to be:

1. Pain and tenderness;
2. Swelling;
3. Ecchymosis;
4. Deformity;
5. Shortening;
6. Results of examination with the X-ray;
7. False point of motion;
8. Crepitus;
9. Altered percussion note;
10. Loss of function;
11. Results of examination under general anesthesia.

It is not to be expected that all signs of fracture will be present in any given case. Most of the signs may also be due to an injury to the soft parts, or possibly to a bruise of the bone itself; but they have a relative value, and if certain of them exist together, and the history of the injury is such as to presuppose a fracture, a sufficiently positive diagnosis can often be made, even though the pathognomonic signs of false motion and crepitus are not obtained and an X-ray examination is out of the question.

Some further explanation of the relative value of these signs is desirable.

1. Pain is one of the least valuable signs, because it varies so in different cases. Its absence is no proof that a fracture does not exist. Tenderness, that is, pain produced by pressure or manipulation, is a far more valuable sign. In almost all fresh fractures pain is caused by pressure directly upon the line of fracture. If it is produced at the point of fracture by pressure made upon the injured bone at some other point, the sign has a greater significance. Take, for example, the case of the ulna, a bone which is often bruised. Pressure on the bruised spot naturally causes pain, whereas pressure on the ends of the bone, made by crowding together the olecranon and hand, will cause no pain. In a case of fracture such pressure will probably cause pain if the solution of continuity is complete. The same difference exists when attempts are made to bend a bone at the suspected point of

fracture. In making these tests one must be careful not to make direct pressure upon the contused area.

2. Swelling of the soft parts is such a common sign after all injuries that its diagnostic value is not of great importance. If the swelling is out of proportion to the apparent damage to the soft parts, or if it persists longer than such apparent damage would warrant, it has some value in establishing diagnosis of fracture. If a deep swelling persists after the edema of the skin has disappeared, its diagnostic value is greater, as it is then probably due to displaced bone or to callus.

3. Ecchymosis has also a relative value in establishing the diagnosis of fracture. If it occurs within a few hours its diagnostic value is slight. If the area of ecchymosis extends for three or four days, the value of the sign as indicating fracture is far greater. This fact indicates positively that some deep blood-vessels have been ruptured, and in case of suspected fracture such blood-vessels are usually in the bone itself. It is unusual to have a fracture without ecchymosis.

4. Deformity, if one can be certain that it is true bony deformity, is a positive sign of fracture or dislocation. The value of this sign rests, therefore, on the completeness of the examination. If the patient is seen immediately after the accident, before the soft parts have had time to swell, even a slight bony deformity is readily made out. On the following day the deformity may be massed by the edema of the soft parts. In a week or more, after the swelling of the soft parts has more or less subsided, the bony deformity will again be more apparent, but from this time forward it will be more or less obscured by the callus.

Deformity due to fracture may be either angular or due to overlapping of the broken ends. Angular deformity is usually easier to make out, especially if the fracture is in a shaft of a long bone. As such fractures are rarely impacted, the angle can generally be increased or diminished by manipulation (sign No. 7).

The deformity due to overlapping, or to driving one fractured end into the other, is easily made out, provided there is no swelling of the soft parts and the bone lies near the surface. If the fracture of the shaft of the bone is transverse, or nearly so, overlapping of the fractured ends will produce a marked deformity, and one that is easily recognized in spite of swelling. This often happens in fractures of the shaft of one of the phalanges and of the humerus. Most fractures are, however, oblique. This is particularly true of fractures near the joints, and it is in just these cases that swelling is great and diagnosis is more difficult. Determination of the long axis of the portion of the bone which can be felt, and its projection, in the mind, beyond the site of fracture, will help the examiner to decide whether deformity exists.

Marked deformity is, of course, produced by dislocation, but a dislocation can in most cases be differentiated with certainty from a fracture by the other symptoms which exist, and which are given in the description of the special fractures and dislocations.

5. Shortening is also a positive sign of fracture, if one is sure of his measurements. Many bones have such definite prominences that accurate measurements can be made and compared with those of the uninjured side. In other cases it is better to extend the measurements beyond the particular bone in question until well marked prominences are reached. Thus, in cases of suspected fracture of the femur, it is customary to measure from the anterior superior spine of the ileum to the internal maleolus.

In some cases a previous injury or deformity of the affected or non-affected side will render comparative measurements worthless.

If a false point of motion exists, measurements of the bone may show a difference when traction is made upon the limb so as to overcome any shortening which exists, and when the ends of the bone are crowded together so as to increase the shortening. This difference in many cases amounts to an inch or more. Measurements are of value not only as proving the existence of fracture, but also to show that reduction has been effected. In all cases comparative measurements should be made upon the sound side.

6. Examination with the X-ray has added more to our knowledge of fractures than all other methods combined. The technic of such examinations is fully explained in special books upon the subject, at least one of which should be in the hands of any one who takes up this method of examination. There are three general points which may well be borne in mind by every one who sends a patient to have an X-ray examination made. The first point is that a negative examination with the fluoroscope should, if possible, be confirmed by a radiograph, since fractures with slight displacement may not be apparent to the eye. The second

point is the necessity of making radiographs in both the anteroposterior and lateral planes, in order to show how much deformity exists in both directions. The third point is this, that many cases of supposed sprain will be shown in a good radiograph to be cases of fracture.

7. A false point of motion is positive proof of fracture. Its absence does not prove the absence of fracture, since the fracture may be incomplete (green stick fracture), or it may be impacted, or it may be so situated that one cannot grasp both portions of the fractured bone in such a manner as to demonstrate their lack of continuity. This is the case in many fractures about a joint. Sometimes the false point of motion can be demonstrated by the abnormal motion which one of the bones making up the joint has upon the other, even though the shorter fragment is quite inaccessible. This is seen after fracture of the so-called anatomical neck of the humerus and fracture of the neck of the femur.

In testing for a false point of motion the bones should be grasped firmly above and below the suspected plane of fracture. Gentle manipulation should then be made, calculated (*a*) to bend the affected bone in an anteroposterior direction, (*b*) to bend it laterally, (*c*) to slide one broken end on the other in an anteroposterior direction, (*d*) to slide it laterally, (*e*) to rotate one end upon the other, and (*f*) to increase and diminish any existing overlapping by alternately pushing up and then making traction upon the bone in the direction of its long axis. These general tests may be varied to meet the requirements in any particular case. They are especially applicable to fractures in the shaft of a long bone. Emphasis is laid on the firm grasp combined with gentle manipulation, for in this way the best results are obtained.

Sometimes, if a small portion of the bone has been broken off, its mobility may be demonstrated by making pressure first on one end or side of the fragment and then upon the opposite one. In this manner it may be tilted back and forth.

If the fracture is near a joint the best result is sometimes obtained by grasping with one hand the main portion of the fractured bone, and with the other hand the bone or bones with which it articulates, thus allowing the small fractured portion to move with the bones beyond the joint. A good example of this is found in fracture of one malleolus, especially when combined with laceration of the ligaments of the opposite side.

8. Crepitus or grating between the broken surfaces of a bone is, of course, a positive proof of fracture when found. It should be tested for with gentleness, according to the directions given in the preceding paragraphs, under the heading "False Point of Motion." Failure to obtain crepitus when a fracture exists may be due to impaction of the fragments, or to lack of mobility, or to the interposition of soft tissues or clotted blood, which allow the bones to move on each other without grating.

A soft or false crepitus is often produced in a joint by an unnatural slipping of one bone upon the other. Thus, the shoulder-joint in many persons habitually gives out a crepitus when manipulated, and any joint may do so following an injury. This source of possible error can usually be eliminated by a comparison with the corresponding joint of the other side.

A blood clot in the vicinity of a suspected fracture will sometimes give a soft crepitus when pressed upon. There is also a possibility of fibrinous crepitus produced by the slipping of a tendon through an acutely inflamed tendon sheath (see p. 343).

9. An altered percussion note was at one time heralded as a sure sign of fracture. A stethoscope is placed over one end of the bone while the other end is tapped. If the bone is intact the sound is transmitted clearly; if the bone is broken the sound is muffled. The difference is noted by comparing the results obtained on the two sides of the body. This test has a limited application. It is obvious that there must be no swelling of the soft parts over the points where the stethoscope is placed and where the bone is tapped, as otherwise a different sound will be produced. Practise has shown that the sound is frequently undiminished, even though a fracture exists, presumably because the fractured ends of the bone are in intimate contact with each other. If the ends are separated there is a distinct difference in the tone. For this reason some observers claim that this percussion-auscultation is a reliable sign of the existence of soft tissues between the fractured ends of a bone, and that if the ends cannot be so approximated that a clear tone will be produced non-union may be expected. Further testimony is needed upon this subject before accepting this statement as final.

10. Loss of function is a valuable sign of fracture, though not an absolute one. The function of a bone is to remain rigid while allowing motion in its associated joints. In a sense, most of the symptoms mentioned above indicate a loss of function of the part, but the term "loss of function," as ordinarily employed, means that the normal use of the portion of the body affected is impossible. For example, after fracture of the tibia the patient cannot bear his weight on the foot. After fracture of the humerus he cannot hold a ten pound weight at arm's length, etc. It is worthy of note that loss of function is usually only partial; thus, after fracture of the fibula alone, the patient can walk upon his heel, but cannot bear his weight upon the ball of the foot. The special limitations of function which follow various fractures form an important part of the knowledge necessary for an accurate diagnosis and treatment of the same.

Loss of function frequently exists without a fracture. Pressure upon contused areas, tensions of damaged muscles and nerves, motion of inflamed joint surfaces, and so forth, may all cause pain, and thus interfere with the normal uses of the body. The exact limitations of function can often be better determined if the patient's attention is directed away from the injured part. The administration of an anesthetic, but not to full anesthesia, is frequently a valuable help in determining loss of function.

11. General anesthesia is of great assistance in the diagnosis of fractures. The patient is thereby spared much pain, the surgeon is put at his ease, the muscles are relaxed so that much less force is necessary in manipulation, and the existence of positive signs of fracture and the relation of the fractured ends to one another are made out with an accuracy which is quite impossible in most cases if no anesthetic is employed. Furthermore, anesthesia is a great help toward the reduction of displacement, but it should be borne in mind that, with the return of consciousness, muscular contraction will again take place, and the fragments may again be drawn out of relation.

TREATMENT.—Successful treatment of any fracture accomplishes three things:

1. Reposition of the fragments;
2. Immobility of the fragments; and
3. Restoration of function.

The patient should be anesthetized whenever for the purposes of diagnosis or reposition of the fragments the surgeon is obliged to use force or cause pain. A snap reposition, like a snap diagnosis, may be correct, but is never justifiable. Before giving an anesthetic, and before reducing the fracture or bandaging the part, sensation and motion in the part of the limb beyond the break should always be tested. Otherwise a subsequently observed paralysis may be ascribed to the surgeon.

1. The fragments are best replaced by manipulation while traction is exerted by an assistant.

Impaction between the fragments should never be broken up if they are in correct line. It should always be broken up if the alinement of the fragments is so bad as to interfere with the proper use of the limb. Whether an impaction should be broken up when the alinement is bad, but the function is not seriously interfered with, depends upon the age and nutritive condition of the patient, the probability that a better alinement can be obtained, the possibility of non-union, etc.

Measurements of the length of the injured bone as compared with those of the opposite side are valuable as showing the amount of shortening and also the success of reduction. Generally speaking, if the shortening is more than a half inch reduction is unsatisfactory. The fragments have not been restored to their normal relations, or the muscles do not allow them to remain in proper relation. In the former case a better reduction should be brought about under an anesthetic. In the latter case extension should be employed.

2. Immobility is secured by splints and extension. The best splints for most fractures are made of plaster of Paris bandages molded directly on the limb. When dry they may be trimmed, if necessary, and covered with canton flannel or some similar material (Figs. 174 and 175, p. 382).

3. Restoration of function can be aided by massage, passive motion of neighboring joints, active motion, hot bathing, dry heat, and electricity.

Massage may be employed with benefit on the day following a fracture, and every day afterward until there is complete restoration of function. For the first few days the limb should be rubbed lightly above and below the seat of fracture. Then one splint may be removed to permit gentle stroking of the injured portion. After two weeks both splints may be removed and more force employed in the rubbing. The splints are of course reapplied immediately after the treatment. By this means the disappearance of the swelling is hastened, the formation of adhesions is kept at a minimum, and the surgeon is given an accurate knowledge of the positions of the fragments at a time when a faulty position may be easily corrected.

Passive motions of the neighboring joints should be made every two or three days, beginning at the expiration of a week. The patient's sensation is the best guide to the extent of the motions, but no motions should be made which will disturb the fragments.

The amount of active motion allowed will depend upon the nature of the fracture. In general, active motion at the nearest joints should not be attempted until the union is sufficiently firm to allow the surgeon to handle the injured portion of the limb readily without fear of displacement. Active motions of more distant joints may be allowed somewhat sooner than this.

Hot water applications, hot packs, and baking in a hot air apparatus are powerful stimulants to circulation, and are serviceable in restoring mobility to stiffened joints after the bony union is firm. The mobility thus gained must be kept up by massage and active and passive motions, or the stiffness will be likely to recur.

Mechanical vibration is a form of massage which is of very great service in the later treatment of fractures.

Electricity is employed with benefit to keep up the tone of muscles grown flabby by some weeks of disuse, and also in cases in which the nerves have been injured at the time of fracture or afterward, by manipulation or by pressure caused by splints or bony fragments or callus.

Separation of the Epiphysis.—There are two special forms of fracture occurring in children, viz., separation of the epiphysis and green stick fracture. An epiphyseal separation is virtually a transverse fracture. In order to avoid deformity, and to favor the proper growth of the bone such a fracture should be reduced most exactly. An anesthetic is desirable in many cases. When such reduction is accomplished union takes place very quickly, there is absolutely no deformity nor shortening of the limb, and the restoration of function is perfect.

Green Stick Fracture.—A green stick fracture is one in which the bone is partly broken, partly bent, as when force is applied to a living sprout. It is not necessary in all cases to complete the fracture. The rule should be to correct the deformity so completely that there is no tendency for it to recur when the force of the surgeon's fingers is removed. Once corrected the deformity does not tend to recur.

Fractures of the Humerus.—Fractures of the humerus are divided into those of the upper extremity, those of the shaft, and those of the lower extremity. Those of the upper extremity of the humerus are again divided into those of the anatomical and those of the surgical neck of the bone; while those of the lower extremity are often spoken of as fractures of the internal condyle, external condyle, T-shaped fractures, etc. The use of the X-ray in the diagnosis of fractures has shown that such classifications have only a general value, and that there is by no means a regular type of fracture of each of the kinds mentioned; but that, on the contrary, the plane of cleavage may run in almost any direction; it may be too irregular to be spoken of as a plane at all, and that often there is more than one break, so that the bone is separated more or less completely into three or more pieces. Hence the great importance of studying each case by itself. The use of the X-ray, both for diagnosis and as confirmatory of reduction of displaced fragments, is greatly to be advised, and should be insisted upon by the surgeon in all doubtful cases.

In almost all cases the fracture is due to a fall.

Fractures of the Upper End of the Humerus.—Fracture of the upper end of the humerus is not a difficult diagnosis to make out, provided the tuberosities are separated from the shaft of the bone. Then, if the arm is grasped at the elbow and rotated by the surgeon the tuberosities do not rotate with it, and a certain diagnosis of fracture can be made, even though crepitus is not elicited. This fracture has been spoken of as fracture of the surgical neck of the humerus, as distinguished from fracture of the anatomical neck. In the latter case, the tuberosities being attached to the shaft, rotate with it. The diagnosis is then more difficult. Even if crepitus is attained, it may be simply the grating so often produced by rotation of the humerus, especially in people who have reached middle age and whose joints have suffered previous inflammation. If crepitus can be obtained by pushing the arm directly up and down, it is more significant of fracture than if it is produced simply by rotation.

The other customary signs of fracture are well marked. Ecchymosis is greater if the fracture involves or passes below the tuberosities than it is if the fracture is through the anatomical neck. The effused blood, directed by gravity and fascial planes, is often most prominent at the elbow.

There is about one-half inch shortening, if the fracture is between the points measured. Crowding the elbow upward will sometimes increase the shortening, and will give pain at the fracture.

False point of motion is often demonstrable, and if the fracture is below both tuberosities, there is often an inward angulation of the shaft.

If the fracture is impacted, the tuberosities will rotate with the shaft, even though the line of fracture is below them. In such a case the diagnosis must be made from the shortening, tenderness, loss of function, ecchymosis, angular deviation of the shaft, if such exists, and the direct palpation of the bone at the fracture. It will be noticeably thickened as compared with the opposite side.

TREATMENT.—In fracture of the anatomical neck of the humerus the arm should be supported and kept close to the scapula by plaster strapping or by a body bandage and a sling. After ten days or two weeks, gentle passive motions should be made to prevent the formation of firm adhesions in the joint. If the bone fails to unite, a painful or much impaired joint results, and an open operation is necessary, either to remove the head of the bone or to fasten it to the shaft by sutures or pegs.

In fracture of the surgical neck the deformity may be corrected by the weight of the arm if the hand be kept in a sling; or additional extension may be obtained by a light weight, two to five pounds, hung at the elbow. A shoulder cap should be made from a plaster of Paris bandage applied in the form of a spica, including the shoulder and extending around the chest (No. 34, Chapter XXI). When dry, all of this bandage should be cut away except an external shoulder cap. This and a short internal splint should be bandaged in place by a soft bandage, and the hand placed in a sling. Massage and passive motion should be begun in two weeks or less to prevent if possible the adhesions which often form in and about the joint.

Fracture of the Shaft of the Humerus.—Fracture of the shaft of the humerus is a common accident, and one which is easily diagnosticated by the false point of motion, which can always be made out. The direction of the displacement will vary according to the site of the fracture above or below the attachment of the deltoid and the origin of the brachialis anticus.

Essential treatment consists in the application of coaptation splints to the arm, with extension at the elbow to overcome shortening, and support of the hand in a sling. As soon as the tendency to deformity or displacement of the broken ends is overcome the extension may be omitted, and passive motions be made at the elbow and shoulder. The hand should be carried in a sling until firm union results.

While fracture of the shaft of the humerus is easily and successfully treated in most cases, it is of all fractures of the body the one most likely to result in non-union. As reasons for this may be mentioned the fact that the bone is a single one of small size, and the further fact that the fracture is usually transverse. Thus muscular traction may cause overlapping. If non-union results the case should not at once be given up as hopeless, nor an immediate operation be advised. There should first be tried absolute rest in a correct position as obtained by a plaster of Paris splint of the whole extremity and shoulder, applied under ether if necessary. If no stiffening of the break is evident after two or three weeks of this treatment, the ends of the fractured bone should be vigorously rubbed together twice a week, the arm being kept at rest in the intervals. Sometimes it is of advantage to omit all dressing, except the coaptation splints, and to allow the patient to use the hand and forearm. This improves the circulation of the limb, and if judiciously carried out, need not increase displacement of the fractured bone. These and similar measures calculated to stimulate the ends of the bone, while preventing an undue amount of motion, may result in a cure, even though union be delayed for six months or more. Should these simpler measures fail, an incision should be made, any soft tissue which is found lying between the fractured ends of the bone should be removed, the ends of the bones should be freshened and shaped to each other as well as possible, and fixed firmly together by a drill passed obliquely through both, and left in position for two or three weeks, or by means of a suture, preferably of materials which will become absorbed in two weeks or more.

Even though no bony union follow fracture of the humerus, the arm is far from useless.

Another complication of fracture of the shaft is involvement of the musculospiral nerve, and paralysis of the extensor muscles of the hand and fingers. The nerve may be injured at the time the bone is broken, or it may be pressed upon later by a splint, or it may be involved in the forming callus. To avoid unpleasant accusations, the surgeon should always test the sensation and circulation of a limb, a bone of which has been broken, both before and after the application of splints. If the function of the musculospiral does not return with the help of bathing, massage, and electricity, the nerve should be exposed and freed.

Fracture of the Lower End of the Humerus.—Fracture of the lower end of the humerus is very common, especially in childhood. The exact line of fracture may extend transversely across the bone, or may separate either condyle, with or without the articular portion; or the injury may be a still more complex one. An exact diagnosis of injuries about the elbow-joint is often impossible. The use of the X-ray is of the greatest benefit under such circumstances, and the surgeon for his own protection, as well as for his own satisfaction and for the benefit of the patient, should insist that a radiograph be taken. The use of an anesthetic is also of the greatest assistance in clearing up the diagnosis, especially in determining how much the normal motions have been interfered with by the injury. Deformity may at the same time be overcome, and the limb placed in a plaster of Paris splint. Whatever the injury, the limb is usually best treated with the forearm flexed at a right angle and held in a position midway between pronation and supination. Either the plaster of Paris or starch bandage should include the hand, or a sling should support the hand, and save the patient from the pain caused by the constant stretching of the radial ligaments of the wrist. The arm should be inspected at least three times the first week and twice a week for a month or longer. After the first week passive motions (rotation of the hand and arm, flexion and extension of the forearm) should be begun. These motions, combined with light massage, should be slight at first, and grow more extensive as the union of the fragments progresses.

Deformity following fracture of the lower end of the humerus is not uncommon, owing to the fact that the lower fragment has united at a vicious angle. Such deformity is most noticeable when the arm is fully extended, and the forearm and hand will then appear to be bent abnormally backward or to one side. If the deformity is not too great, and especially if the motions of the elbow are free and painless, operative interference should be advised against.

Another common after-effect is limitation of flexion and extension. Flexion is usually affected to a greater extent than extension. If motion in the joint is prevented by swelling merely, this may be overcome by use of the arm and massage. But in other cases there is a mechanical obstruction to flexion or extension, which will not yield to such simple measures. Under such circumstances an anesthetic (preferably nitrous oxid) should be given, since if the motion is limited by adhesions, these may be broken up. In many instances the limitation of motion is due to the formation of callus and new bone at or near the line of fracture; so that the function of the joint, instead of increasing, may grow less as the weeks go by. This bony irregularity is due to imperfect reduction. If recognized early by an X-ray examination it may be corrected by manipulation. At a later date, if the limitation of motion is still considerable, sufficient say to prevent the patient from putting the hand up to the head, and continues in spite of a thorough course of treatment by massage, and active and passive motions, extending over several weeks, and if under an anesthetic the forearm cannot be flexed much beyond the point to which it can be flexed without the anesthetic, an operation is indicated. Possibly the bony outgrowth may be chiseled away, so that an increase of flexion is possible. If ankylosis seems inevitable, the surgeon must choose between fixing the elbow at the most favorable angle, a little less than a right angle, or resecting the elbow-joint. The effect of this is to give a fibrous flail-like painless joint at the elbow, which enables the patient to do far more with the hand and arm than is possible with a fixed joint, no matter at what angle.

Fractures of the Ulna and Radius.—**Fracture of the Olecranon Process of the Ulna.**—Fracture of the olecranon is due to falls upon the elbow. The diagnosis is easily made, since the olecranon is movable upon the ulna, often with crepitus. The fragments may be separated in flexion of the forearm, so that the injury is best treated by placing the extended arm on a splint

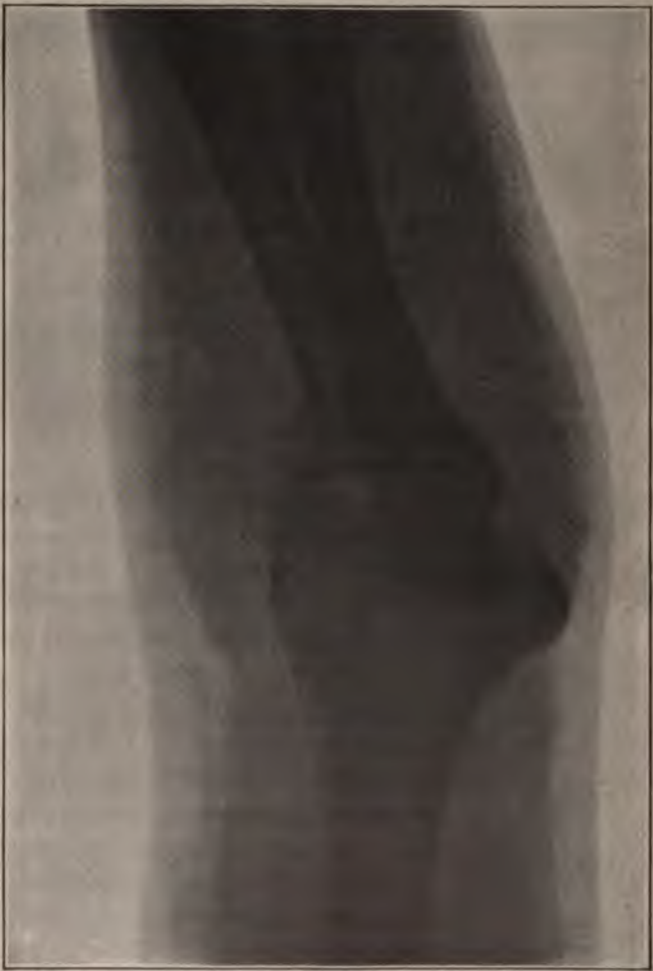

Fig. 172.—Radiograph of Fracture of the Neck of the Radius Occurring in a Woman Aged Twenty-seven Years, Who Fell from a Bicycle While Going Downhill. Functional result after treatment was excellent.

for ten days or two weeks, and then beginning possible motion to prevent adhesions in the elbow-joint.

Fracture of Head of Radius.—Fracture of the head of the radius, or of its neck, is due to falls upon the hand (Figs. 172 and 173). The rarity of this fracture is a matter for surprise. Doubtless it has often been overlooked, and the diagnosis made of sprain of the elbow-joint or fracture of the external condyle of the humerus.

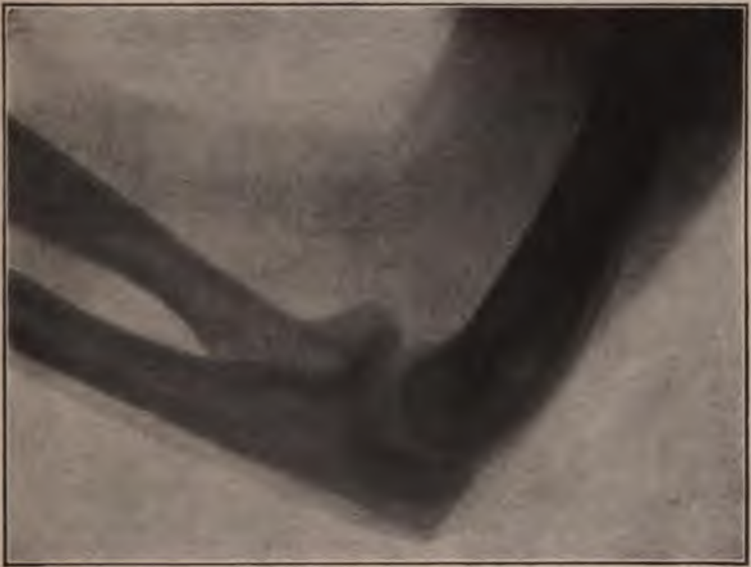

FIG. 173.—SAME SUBJECT AS FIG. 172. Radiograph giving lateral view of fractured radius.

The symptoms of fracture of the head of the radius are the general ones of fracture everywhere. Pain is also produced by crowding upward the palm of the overextended hand; pronation and supination are also extremely painful, and may be impossible. This fact, together with the fact that the maximum swelling and tenderness is below the plane of the elbow-joint, and the further fact that pressure upon the two condyles does not elicit pain, will serve to differentiate an uncomplicated fracture of the head of the radius from fracture of the external condyle. An X-ray examination is often necessary to establish the diagnosis.

Treatment.—Deformity should be overcome if possible, and the forearm immobilized at an angle of ninety degrees, midway between pronation and supination, for two weeks. Then passive motions, both flexion and extension and rotation (very gentle), should be commenced and gradually increased, the arm being kept in a sling for at least two weeks longer. In some cases permanent limitation of motion, especially of pronation and supination, makes it necessary to remove some of the displaced bone.

Fracture of the Shaft of the Ulna or Radius.—Fractures of the ulna or radius, or of both of these bones occurring in the shaft, are usually made out without difficulty. The ulna lies so close to the skin that a break in it can be easily determined by direct palpation, while the attachment of the hand to the radius helps in the diagnosis of a fracture of this bone, in cases in which the ulna is not broken. The hand and lower fragment of the radius can be moved independently of the ulna to a short distance, and hence a false point of motion in the radius can be made out almost as easily as it can be in the humerus or femur. When both bones are broken the diagnosis is extremely simple in adults. In young children it sometimes happens that one or both bones are partially broken as the branch of a living tree breaks on one side and bends, hence the term "green stick" fracture (see p. 371).

Treatment.—If a green stick fracture exists, in order to get the bone to remain in a correct position, it is often necessary to overcorrect the deformity. In so doing, the remaining portion of bone may be broken through. This in itself is not a serious accident, and is preferable to allowing the deformity to remain only partially reduced.

In other respects fractures in the middle of the forearm are easily treated. When the deformity has been overcome by manipulation, the hand should be placed midway between pronation and supination, and the bone should be kept quiet by means of light anterior and posterior splints, or a light plaster of Paris bandage. If the plaster is fresh and is applied before it has time to set there is no need for such a bandage to be more than an eighth or a twelfth of an inch in thickness. The heavy cumbrous bandages which are sometimes applied are by their very weight not only uncomfortable, but injurious to the patient.

The position of the hand has been a matter of considerable dispute. Some writers have said that the hand should be fully supinated in order to prevent the callus from uniting the radius and ulna. They have stated that the bones were most widely separated in extreme supination. Others have denied this, claiming that the separation is greatest in a position between pronation and supination. An examination of any cadaver, or of the forearm in life by means of the X-ray, will show that the distance between the bones is almost the same whether the hand be held two-thirds supinated or be fully supinated. Since this is the case, the comfort of the patient demands that the hand be placed with the thumb directly upward, the elbow being flexed at a right angle. This is the natural position of the forearm, and to hold the hand for a long time fully supinated when the forearm is flexed at a right angle is a tiresome procedure in health, and well-nigh impossible if the arm is broken.

In fracture of the radius there is a chance of the interposition of muscle or fibrous tissue between the broken ends, while the numerous strong muscles cause overlapping if both bones are broken. The possibility of non-union should always be borne in mind if crepitus is not elicited when the fracture is fresh, or if there is still motion at the line of fracture in a month or six weeks. But the surgeon should not be too impatient nor turn too quickly to an open operation, the results of which are by no means invariably good. Moreover, it sometimes happens that union which has been delayed for six or eight weeks will nevertheless take place spontaneously under the more favorable conditions of massage, and an occasional rubbing together of the ends of the bone.

If both radius and ulna are broken, and non-union results, pronation and supination of the hand are impossible. If a single bone is broken, pronation and supination is at first impossible, but later is possible to a certain extent, even though only a fibrous union exist between the fractured ends.

Pronation and supination are also limited by angular deformity of one or both bones, and are absolutely prevented by a bony union of radius to ulna. A complete crossed union of radius and ulna, i. e., the union of the lower fragment of the ulna with the upper fragment of the radius, and *vice versa*, probably never occurs, but any bony fusion of these bones is equally destructive of the function of rotation of the hand, and is an absolute indication for operation. To prevent such fusion, some authors advise the use of splints, the center of each of which is elevated in a ridge, intended to press between the radius and ulna, so as to keep the bones apart. This device is theoretical rather than practical.

Fracture of the Lower End of the Radius (*Colles's Fracture*).—Fracture just above the wrist-joint, always involving the radius and sometimes the tip of the ulna, and known as Colles's fracture, after the surgeon who accurately described it, is one of the commonest fractures which the surgeon is called upon to treat. The study of radiographs of this injury is most instructive. Such pictures show that the line of fracture may extend in almost any direction. The lower end of the radius may be broken into several pieces, or there may be a single break either involving the joint or extending across the bone in a more or less oblique direction wholly above the joint. The radiographs also show that the lower end of the ulna is involved in about a third of the cases, a fact which is rarely made out clinically, and which has little bearing on the treatment.

In Colles's fracture the lower end of the radius may be displaced in any direction. The common displacement is upward and backward. This, with the fact that the plane of the articular surface is often bent a little backward, causes what is known as a silver fork deformity, the hand assuming something of the curves of an ordinary table fork. The other signs of this fracture are a displacement upward of the styloid process of the radius when compared with the styloid process of the ulna, tenderness, ecchymosis, and possibly abnormal motion and crepitus.

TREATMENT.—Owing to the breadth of bone and its spongy character, and to the fact that the injury is received usually by a fall upon the hand, the lower fragment of the radius is often impacted in the shaft. False motion and crepitus will then be absent, but an abnormal thickening and irregularity of the bone may mark the plane of fracture. If no deformity exists, there is no need of breaking up this impaction. The injury is much simplified thereby, and in two or three weeks the patient will begin to have free use of his hand. Such a fortunate condition is rare. The impacted fragment is almost always set into the shaft at a false angle, hence the necessity for breaking up the impaction and restoring the normal relation of the parts. This can best be done under the influence of a general anesthetic, nitrous oxid being well suited to the purpose. It is extremely important that any existing deformity should be thoroughly reduced. Under no circumstances should the surgeon trust to pressure obtained by splints to reduce the deformity. The strength of the structures forming the wrist-joint and the nearness of the plane of fracture to the joint itself make it almost impossible to overcome deformity by pressure, and a firm pressure easily causes necrosis of the skin overlying the back of the wrist. If impaction has been broken up and the deformity has been thoroughly reduced, there will be little tendency to recurrence except through muscular contractions. To avoid this the hand should be kept at rest by anterior and posterior plaster splints, extending at least to the metacarpophalangeal joints. In difficult cases these should be applied while the patient is thoroughly anesthetized and muscular contraction eliminated.

If there is any doubt as to the diagnosis and perfect reduction cannot be obtained and kept up, a good X-ray picture of the injury in the anteroposterior and lateral planes should be insisted upon. If the patient refuses this aid to diagnosis and treatment, there will be little ground upon which to rest a suit for malpractice in case the function of the hand is not fully restored.

A great many different forms of splints have been advocated for this injury. Good results have been obtained with all of them, and indeed in many cases with no splint whatever, the hand being merely carried in a sling with a broad strap of rubber plaster about the wrist to support the broken bone. Others have advocated carrying the forearm or hand in a sling, the edge of which reaches only to the line of fracture, and thus permits gravity to prevent the recurrence of the deformity. Such an apparatus is needlessly simple and places too great responsibility upon even an intelligent patient. The advantages claimed for it are the avoidance of stiffness in the wrist-joint and a hastening of the time of repair by means of massage and passive motion. These advantages are very great, especially in persons past middle age, but they can be readily obtained by the frequent removal of well fitting anterior and posterior splints, while the splints protect the patient against possible accident and are far more comfortable than the sling alone. They are made as follows:

A two or three inch crinoline gypsum bandage should be wet and drawn back and forth on a board or marble slab for a distance of fifteen inches until twelve or fifteen thicknesses are made to overlie each other. They are thoroughly rubbed together. A second bandage is used to make a second strap splint. The fracture is reduced, and the hand of the patient put in whatever position of flexion, extension, abduction, or adduction best keeps the reduced radial fragment in correct position. The skin is anointed, and the moist plaster strap splints are then applied and approximated with a gauze bandage (Figs. 174 and 175). The hand and forearm are held for ten or fifteen minutes till the plaster has partially set. In this manner two light rigid splints are obtained which are accurately molded to the part, and which can be applied and removed at pleasure, and which fit far better than any wooden or metal splints can possibly do. In three days the splints should be removed for light massage, and reapplied. This treatment should be repeated every two or three days until three weeks have passed. After the first week gentle passive motion may be made at the wrist, and the fingers flexed and extended by passive motions several times. If the deformity caused by the fracture has been fully reduced at the start, an arm treated in the manner described will be pretty nearly well in three weeks. There will be no pain and very little tenderness and swelling of

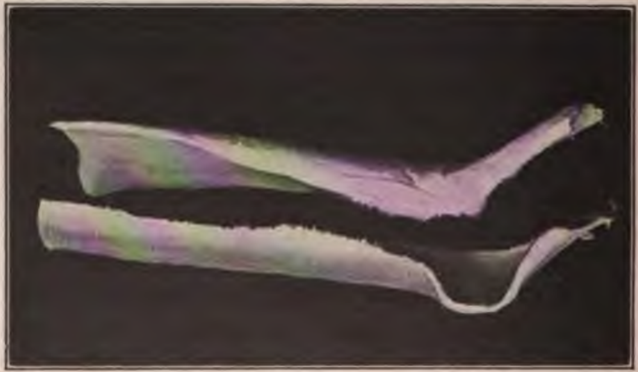

FIG. 174.—MOLDED GYPSUM SPLINTS FOR FRACTURE OF THE LOWER END OF THE RADIUS. Photographed after removal from the limb.

the wrist, and the patient may be allowed to go without a splint and to begin active motions of his hand while continuing daily bathing and massage, and resting the forearm and hand in a sling when he is not using it. Cases which give trouble are those in which the deformity is not thoroughly reduced soon after the accident.

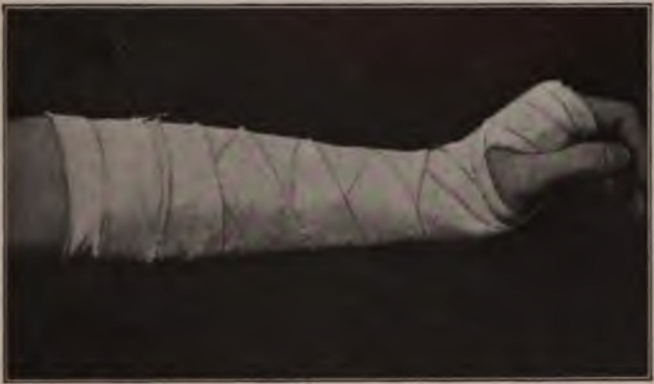

FIG. 175.—SAME SPLINTS APPLIED. This position of the hand is desirable in many cases, to prevent recurrence of deformity.

Cases of Old Colles's Fracture.—The surgeon is often called upon to treat cases of Colles's fracture in which the injury occurred some weeks or possibly months previous. Under such circumstances the first question to be answered is the desirability of an attempt at reduction of any existing deformity. The patient will complain either of pain or of limitation of motion or of deformity, possibly all three. It is hard to say in just how long a time the union between the fragments will become so firm that it will not be possible to separate them without a cutting operation. This will depend to a considerable degree upon the amount of impaction produced by the injury. In doubtful cases it is better to give the patient an anesthetic and to make an attempt to reduce existing deformity, even if it does not succeed. It is a satisfaction to the patient to know that a fair attempt has been made to reduce the deformity without an operation, and, moreover, while under an anesthetic, adhesions between the various bones of the wrist may be broken up, and thus a greater amount of movement be obtained. In considering the question of an open operation, the accessibility of the radius and the probability of a reduction of the deformity are the favoring conditions, while the scar and the risks incident to operations upon bones, especially in the vicinity of a joint, are to be considered as against operation.

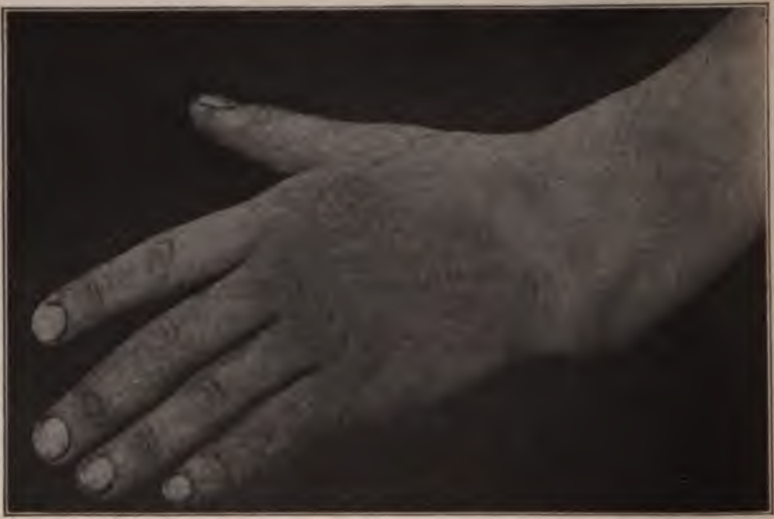

FIG. 176.—OLD FRACTURE OF RADIUS (COLLES'S) WITH MARKED DEFORMITY, BUT GOOD USE OF HAND.

The extreme deformity of an old unreduced fracture of the radius is shown in Figure 176. Yet this patient had good use of the hand.

Fracture of the Carpus.—Fracture of one or more carpal bones is not a very common accident. It has to be differentiated from sprain. In a recent state this diagnosis cannot usually be made without the help of the X-ray. Later the marked limitation of motion, pain, and abnormal thickness of some portion of the wrist may suggest the true diagnosis. The os magnum and semilunar bones are most often broken.

The treatment is the same as that of a severe sprain. If a portion of a bone is so displaced as to interfere with motion, it should be removed.

Fracture of a Metacarpal.—Fracture of one or more of the metacarpals is a very common injury. It results almost always from blows with the fist, the force coming against the knuckle—that is, against the head of the metacarpal. The line of fracture is usually just above the head of the bone, although it may be higher up. There is almost invariably an anterior displacement of the distal fragment, thus causing a depression of the knuckle at the back of the hand. This looks at first glance like a dislocation of the phalanx until one considers that the knuckles are formed entirely by the metacarpals, if the fingers are flexed.

If the injury has been recently received the diagnosis is easy, characteristic signs of pain, false point of motion, and crepitus being present.

The deformity is best reduced in most cases by flexing all the fingers over a ball of yarn or a gauze bandage placed in the hollow of the palm (Fig. 177). The fingers should be strapped or bandaged in this position, and the dressing should be removed for bathing and massage two or three times a week. Union takes place in these small bones very rapidly, and in young subjects two weeks is generally sufficient to produce a callus strong enough to prevent displacement. The bandage may then be omitted, and the patient simply cautioned against severe use of the hand for two or three weeks more.

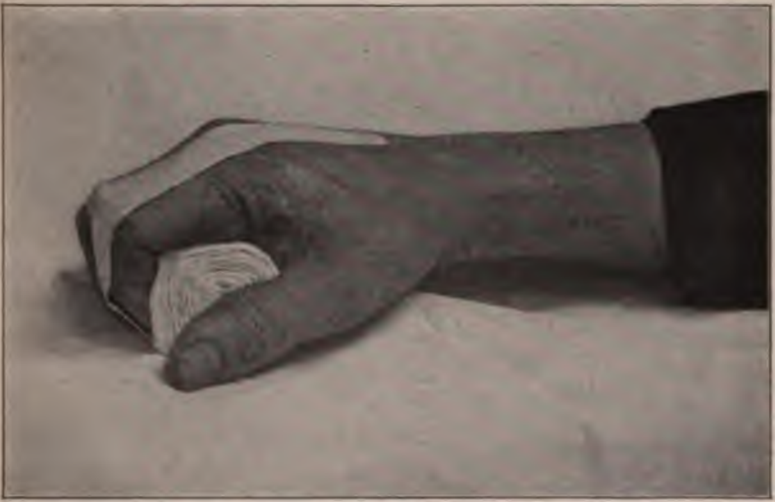

FIG. 177.—FRACTURE OF SECOND RIGHT METACARPAL. Deformity corrected by flexing the hand over a bandage held in the palm, with adhesive plaster strapping.

Fracture of a Phalanx.—In fracture of the first phalanx it is sometimes difficult to prevent recurrence of the deformity, owing to the constant pull of the anterior and posterior tendons, and the further fact that the web between the fingers prevents the application of a circular bandage. This, of course, does not apply to the thumb. It is the fifth finger in which the first phalanx is most often broken, on account of its small size and exposed position. It should be treated on a splint, preferably of tin, curved to fit three sides of the finger and hand. (Cf. Fig. 211, p. 426.) The deformity may be overcome by allowing the splint to extend beyond the end of the finger, and by making extension by means of longitudinal strips of plaster fastened to the finger and reaching out beyond it to the end of the splint. Counterextension to hold the splint in place is obtained by similar adhesive straps about the wrist.

Fracture of the second or third phalanx is easily treated. The pull upon the distal fragment is slight, and the deformity may be kept down by winding rubber plaster around the finger while extension is being made by an assistant.

COMPOUND FRACTURES

Compound fractures of the upper extremity should be treated from the very first aseptically, if possible. If the materials for a thorough cleansing of the wound are not at hand, a compress and bandage should be applied and one or two splints to keep the parts quiet until preparations can be made for a proper surgical dressing. When the wound has been cleansed and drained and the deformity reduced, the treatment of the fracture does not differ materially from that of a simple fracture, provided that no suppuration ensues. The splints should be so arranged that they may be easily removed to permit dressing of the wound, or a window may be cut for this purpose. If the wound heals aseptically, a longer time is required for bony union than is the case with simple fractures. Hence massage and passive motion cannot be begun usually until the third week.

Suppuration occurring in a compound fracture will show itself locally by increased edema and tenderness near the wound and a discharge of pus; or if the discharge is interfered with, by extension of the pain up the arm, swelling and tenderness of the regional lymph-glands above the elbow or in the axilla, and by the general symptoms of fever, headache, and malaise. These general symptoms are naturally more noticeable in cases of compound fracture of the larger bones, but they also exist in fracture of the hand and fingers with infection. The local signs are usually sufficient to show the surgeon whether repair is progressing favorably, but it is well to note the general symptoms even in these minor forms of fracture.

Crushed Fingers.—The typical case of compound fracture in which ambulant treatment is demanded is a crush or cut of one or more fingers (Fig. 178). The treatment to be followed in such a case is: Cleansing of the skin with soap and hot water, turpentine, and either alcohol or ether; cleansing of the wound with saline irrigation and sponging; control of hemorrhage by pressure or ligature; inspection of the wound; removal of any foreign substance and of detached bits of bone; adjustment of the fractured bone, and suture with chromic gut if the fragments cannot be kept in place by splints. Whether the wound is sutured or drained will depend upon circumstances. The circulation of the hand is so good that compound fractures often heal without suppuration; but as

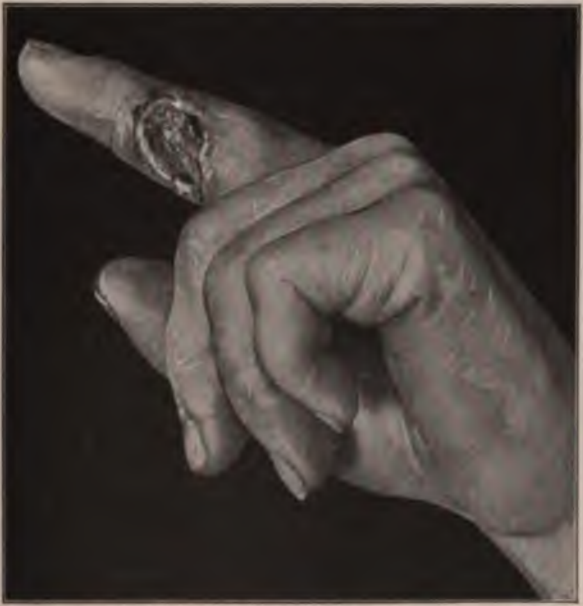

FIG. 178.—COMPOUND FRACTURE OF THE SECOND PHALANX OF FOREFINGER. A simple case.

rubber tissue drains do not cause pain or irritate, their use is to be recommended in this class of wounds. They should be removed in two days, and not reinserted if there are no signs of infection. The skin sutures should be of fine plain catgut or of very fine silk. They should not be placed too close together, since there is considerable oozing of blood and serum for a day or two. The hand and fingers should be dressed with dry sterile gauze or with gauze moistened with some mild antiseptic, such as borolyptol, 1:10, or creolin, 1:200, and placed on a palmar splint. Individual splints to the fingers are not usually needed. A moist dressing favors the escape of secretions from the wound and adds greatly to the comfort of the patient. It should not be covered by oil-silk or anything which prevents evaporation, but should be wet several times a day with sterile water. *Never use carbolic acid for a continuous wet dressing.*

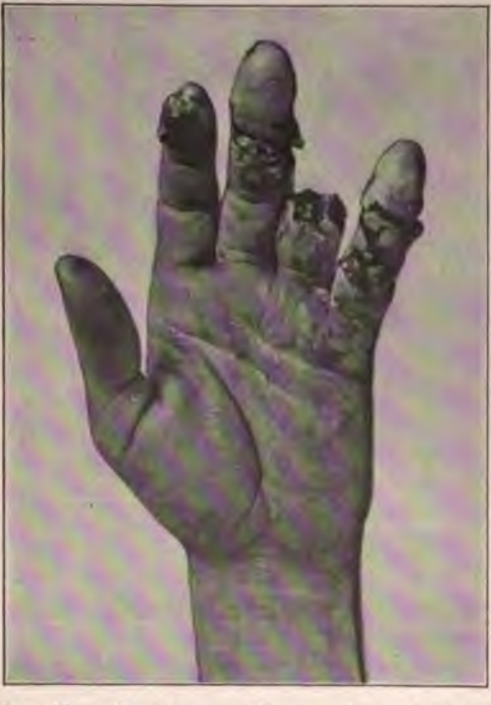

FIG. 179.—INJURIES TO FINGERS FROM CONTACT WITH A BUZZ-SAW. Compound fracture, compound dislocations, and traumatic amputation.

If the fingers are badly crushed or torn, nice judgment is often needed to get the very best result for the patient. The temptation is great to amputate and stitch up the wounds completely. The neatness of a stump covered by well shaped flaps appeals to the surgeon, but not to the patient, whose attention is wholly fixed on the lost member. The extra time required for complete cure is not considered by most patients, if a longer finger is thereby secured. It is true that some laborers find a stiff finger, either flexed or extended, so much in the way that they ask to have it removed. The finger in such cases is generally the middle or ring finger, in which there is ankylosis of the first phalangeal joint and loss of the long flexor tendon. No one ever asks to have his thumb shortened for ankylosis. The fact, therefore, that a useless finger is sometimes voluntarily sacrificed has a very limited application to the treatment of traumatisms of the fingers.

It is far better to pursue a conservative course, and never to sacrifice a flap of skin, no matter how slender its attachments, which can be used to cover a bone, and never to remove a phalanx which can be covered or nearly covered by normal skin. If only the base of a phalanx is left, it is better to remove it in order to avoid tenderness in the stump.

There are many recorded instances of the reattachment of a finger or part of a finger which was almost severed from the hand by a traumatism. Such a case is shown in Figure 179. A buzz-saw wounded the second digit, disjointed the terminal phalanx of the third, dividing most of the soft parts, amputated the fourth, and disjointed the terminal phalanx of the fifth, while the soft parts of this finger were stripped from the middle phalanx and divided by spiral cuts which almost encircled the finger. Measured at right angles to the cuts, the undivided pedicle was about one-third of an inch wide. The wounds were stitched loosely and the hand kept upon a splint and dressed daily with

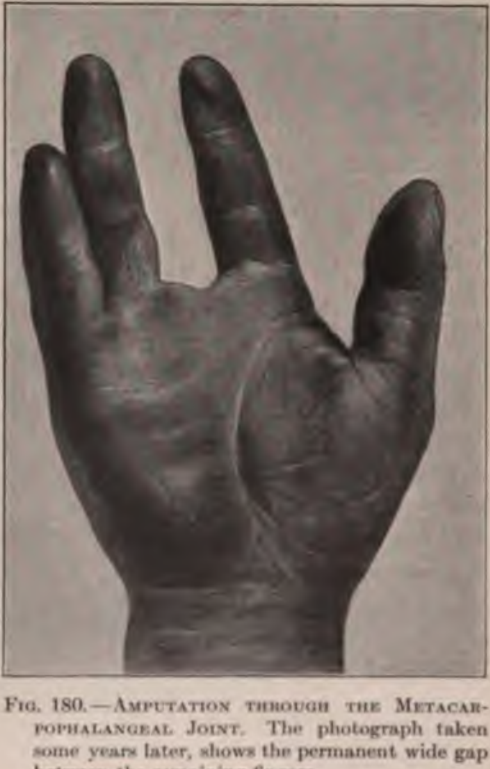

FIG. 180.—AMPUTATION THROUGH THE METACARPOPHALANGEAL JOINT. The photograph taken some years later, shows the permanent wide gap between the remaining fingers.

moist gauze. The photograph was made the day after injury. After four weeks' conservative treatment, the only loss was the terminal phalanx of the third digit and a small portion of the skin of the fifth.

AMPUTATION OF A FINGER

In amputating a finger, if there is plenty of skin with which to cover the end of the bone, a racket shaped flap, preferably from the palmar surface, is best. But, whatever the end of the stump at first, it invariably becomes smooth and rounded from constant use. The chief point, therefore, is to have the flaps long enough so that the skin may move easily over the bone. Tendons and nerves should be cut off short. Horsehair is an excellent suture material for the skin. A few

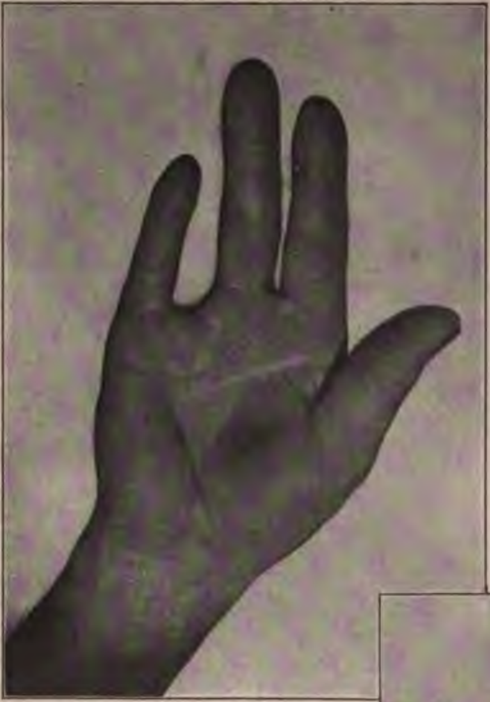

FIG. 181. — AMPUTATION OF THE FOURTH RIGHT DIGIT WITH THE HEAD OF THE METACARPAL BONE.

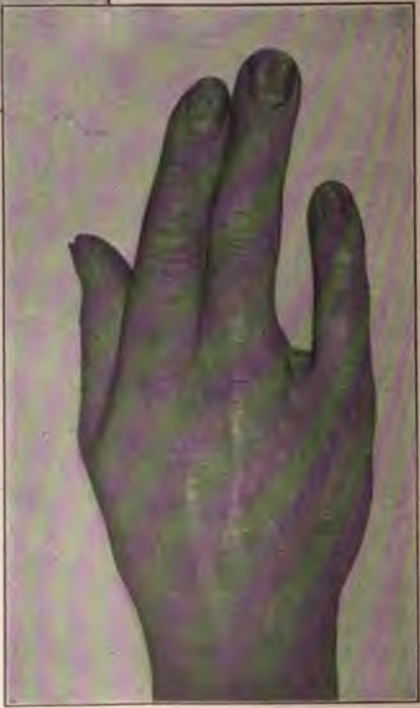

FIG. 182.—SAME SUBJECT AS FIG. 181, POSTERIOR VIEW.

hairs twisted together, and then doubled and allowed to twist on themselves, make an excellent drain. This should be passed from side to side of the finger, between the skin flaps and the end of the bone, to permit the escape of serum and blood. If suppuration is feared, a wet dressing is preferable. A small amount of suppuration can usually be overcome by irrigation through the drain openings with peroxid of hydrogen and water, 1 : 6, without entire separation of the flaps.

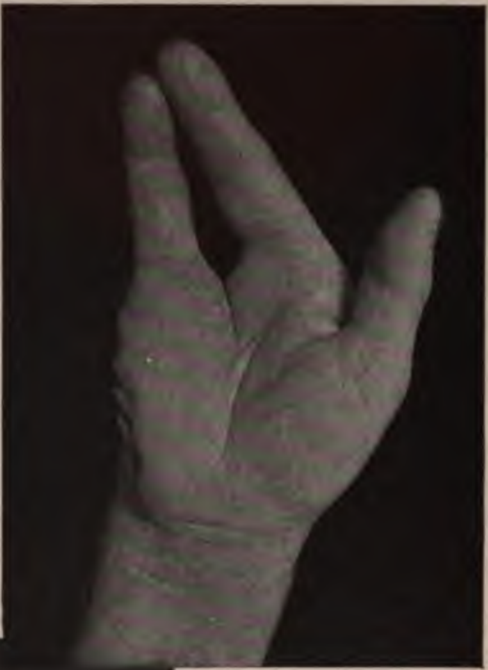

FIG. 183.—AMPUTATION OF TWO CENTRAL FINGERS WITH THEIR METACARPALS. The photograph taken many years later shows the approximation of the remaining fingers, as well as the great development of the little finger.

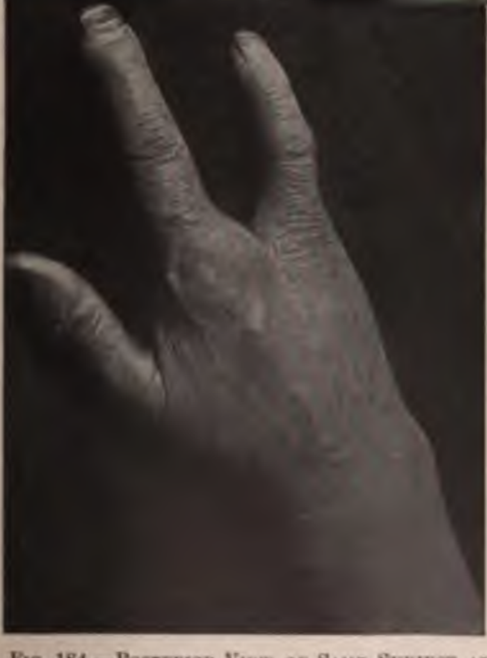

FIG. 184.—POSTERIOR VIEW OF SAME SUBJECT AS FIG. 183.

If amputation is to be performed as high up as the metacarpophalangeal joint, the surgeon must decide whether or not he will remove some portion of the metacarpal bone. The strongest hand is gained by leaving it intact; so, if appearance is not to be considered, the decision should be to leave the whole metacarpal (Fig. 180).

The deformity caused by the loss of the finger is, however, less conspicuous if the head of the metacarpal is removed (Figs. 181 and 182). While this is true for a single metacarpal in the center of the hand, it is an open question whether the heads of the third and fourth metacarpals should be removed for esthetic considerations, since a depression thus caused would be very conspicuous, as, indeed, is the deformity no matter what the treatment.

Another plan is the removal with the phalanx of the greater portion of the metacarpal, or even the whole bone. This is probably the best method to pursue if the fifth, or fourth and fifth, fingers are lost, since in this manner the ulnar side of the hand can be made more smooth. The result of the application of this principle to the loss of the two central fingers is shown in Figures 183 and 184, taken many years after the operation. This was the hand of a hard working woman, as may be inferred from the strong development of the little finger.

CHAPTER XV

INFLAMMATIONS OF THE ARM AND HAND

EFFECTS OF HEAT AND COLD

Burns.—The hands and arms are especially exposed to burns by steam, boiling water, flame, electricity, and the rays of the sun. The treatment is such as indicated on page 26. If the burned surface overlies a joint it is desirable to keep the limb in such a position that the motion of such joint shall not be interfered with by contraction of the resulting scar. Hence a single splint is often of great value in the treatment of burns, especially in children. If the burn be a deep one, and situated over a joint, skin-grafts should be applied in order to hasten the healing and prevent contraction of the scar. The grafts should be large and should comprise a considerable part of the thickness of the skin. They should not be applied until granulation is well established. For the technic see Chapter XX.

Mangle Injury.—An injury peculiar to cities is produced by a laundry machine called a steam mangle, which has two large steam heated rollers through which clothing is passed in order to dry and smooth it. If the girl who feeds the machine has the misfortune to press her fingers between the rollers, the hand will be drawn forward and crushed and burned at the same time. As a result of this accident the fingers or the hand, or even the hand and a part of the forearm, will be ironed out flat and at the same time severely burned. The disfiguration is, of course, very great, but the rule holds good, none the less, to sacrifice no portion of the hand or finger in which the vitality is not absolutely destroyed. Skin-grafts may be used to take the place of skin which has been burned or torn away. Unfortunately, function is destroyed by this accident to a considerably greater distance than vitality, so that, even though the fingers or a considerable part of them be preserved, the hand may be stiff and nearly useless. But even such a deformed hand is far better than an artificial substitute.

Frost-bite.—Exposure of the hands to cold not severe enough to actually freeze the tissues may produce a condition marked by congestion and edema and analogous to chilblains of the feet. There will be symptoms of numbness, alternating with burning pain. Those who are exposed to cold should protect their hands by heavy leathern mittens, and should stimulate the circulation in the fingers by dipping the hands alternately into hot and cold water. Similar treatment should be employed daily in the case of hands already chilled, and following this the skin should be well rubbed with a mildly stimulating ointment, such as ichthyol.

In the usual frost-bite of the fingers the action of the cold has been sufficient to shut off all circulation until some of the tissues have died. When the hands are thawed out slowly, by rubbing with snow or rubbing in cold water, it will be seen that no blood circulates in parts of the fingers. Such parts remain cold and dark when the rest of the hand becomes warm. The color passes, in a day or so, from a dark red to reddish black or greenish black, and it is evident that dry gangrene exists; or, if there is plenty of moisture, blisters may form under the skin.

TREATMENT.—In no part of the body is it more important to preserve as much of the tissue as possible. Hence, from the beginning, treatment should be directed toward that end. After the hands have been slowly brought to a normal temperature they should be kept warm and dry by wrapping them in cotton, so as to favor the efforts of the circulation to keep up the vitality. This is perhaps best accomplished by an ointment spread upon gauze, or applied directly to the finger and covered with gauze, outside of which a thick layer of non-absorbent cotton should be placed and bandaged without much pressure. Such an ointment often contains tannic acid or other astringent for the purpose of keeping down the edema in the tissue which has been injured but not destroyed.

Immediate amputation is strictly contraindicated. It often happens that the apparent gangrene is merely superficial and that a finger may live and remain useful an inch or more beyond the line of demarcation of the skin. Even if such a happy result does not follow delay, nothing is lost by conservative treatment, and the patient is more easily reconciled to the removal of a portion of a finger after he sees that all attempts to preserve it have failed. Compare what is said upon this in the following paragraphs on carbolic gangrene.

Gangrene from Carbolic Acid and Other External Causes.—Gangrene of the finger is still frequently caused by the injudicious use of carbolic acid, in spite of all that has been written on this subject. Sometimes the responsibility for this rests with the patient, sometimes he acts at the suggestion of a friend, sometimes a druggist is at fault, and sometimes, sad to tell, a doctor applies the deadly lotion.

If carbolic acid is spilled upon the skin accidentally, its caustic action may be prevented by promptly bathing the part with alcohol; but in most of the cases in which gangrene is produced a solution of the acid is employed, and the destruction of the skin, taking place slowly and often painlessly, is not recognized until hours have elapsed. It is then too late for relief to be obtained by bathing with alcohol.

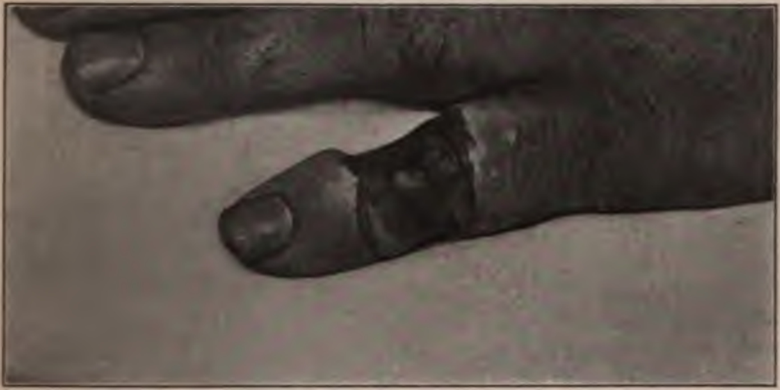

FIG. 185.—PARTIAL GANGRENE OF FINGER DUE TO CARBOLIC ACID. There was loss of the true skin over a part of the circumference of the finger only. No operation was performed. Recovery with perfect function of joints and tendons, but with a permanent scar. Notice the swelling of the living tissue adjoining the gangrene.

Gangrene has frequently been produced by the application of a five per cent solution of carbolic acid in water, and in some instances by the use of a watery solution of only one per cent. Experiments show that a similar gangrene may follow the application of five per cent solutions of caustic potash, acetic acid, or mineral acids.

Carbolic gangrene is dry and usually painless. The affected part is at first dark gray or brown, and as the tissues dry and shrivel they grow darker, so that they become almost black (Fig. 185 and Fig. 186). In a few days a line of demarcation is established between the dead and living parts, and there is some swelling of the latter, due to absorption of septic material along the line of separation. In a few cases this absorption may lead to a well marked cellulitis with the formation of pus pockets (Fig. 187).

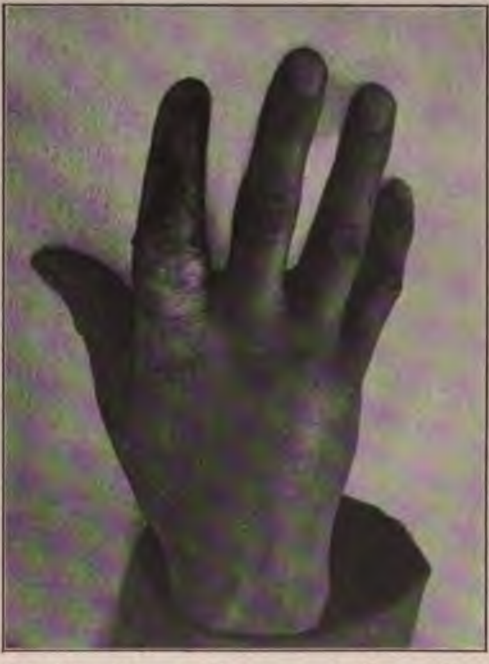

FIG. 186.—CARBOLIC GANGRENE OF DISTAL HALF OF FINGER, PHOTOGRAPHED ONE WEEK AFTER THE APPLICATION. When first seen the gangrene extended beyond the web of the finger. It was superficial over the proximal phalanx, and the sloughing of the gangrenous epidermis exposed the living skin beneath, as can be seen in the photograph. Two weeks' delay in performing the amputation enabled the surgeon to save the proximal phalanx, and to cover it with good flaps.

The termination of the gangrene varies according to its extent. Thus there may be loss of the superficial skin only, without permanent scars, or a part of the corium may be destroyed, or the deeper tissues, including the bones. The line of demarcation becomes established, granulations spring from the proximal side of the line, and attempt to close the wound. The bones and tendons will resist disintegration longer than the other tissues, but they, too, must yield in time, so that in favorable cases a spontaneous cure may take place.

TREATMENT.—The treatment of carbolic gangrene is at first conservative. As in frost-bite, and other forms of gangrene from *external* cause, the parts should be kept warm and dry, and amputation should be postponed until the line of demarcation through the true skin is established. Not until then is the surgeon able to decide positively how much of the finger can be preserved with benefit. This delay of ten days or two weeks also increases the vitality in the partially damaged skin, so that it can be used successfully for a flap after two weeks, when the same flap would certainly not have been viable if amputation had been performed as soon as the gangrene was noticed.

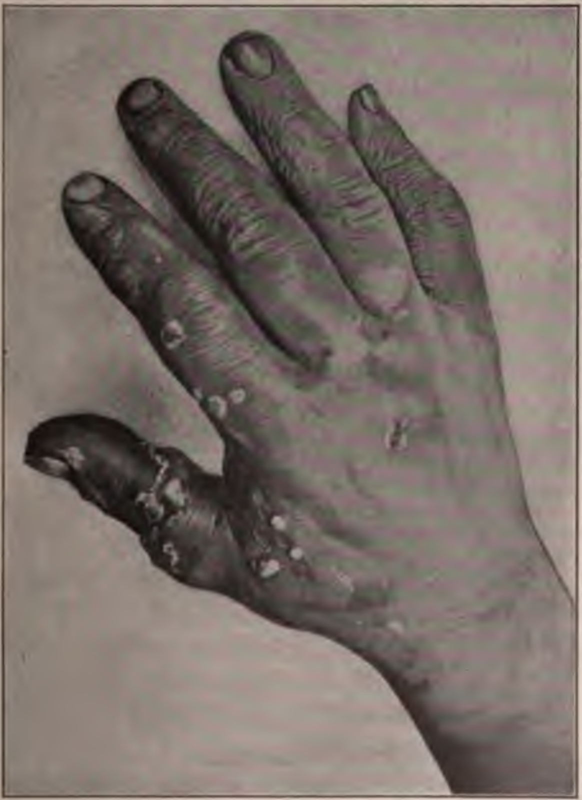

FIG. 187.—CARBOLIC GANGRENE OF THE THUMB, COMPLICATED WITH CELLULITIS OF THE THUMB AND HAND. Sero-pus escaped through the incisions made to relieve tension.

Sometimes the gangrene is complicated with cellulitis. On this account, while waiting for a distinct line of demarcation, the surgeon should inspect the affected finger daily. If tension due to swelling interferes with the circulation, or if abscesses form, incisions should be made, so that the gangrene may not extend (Fig. 188).

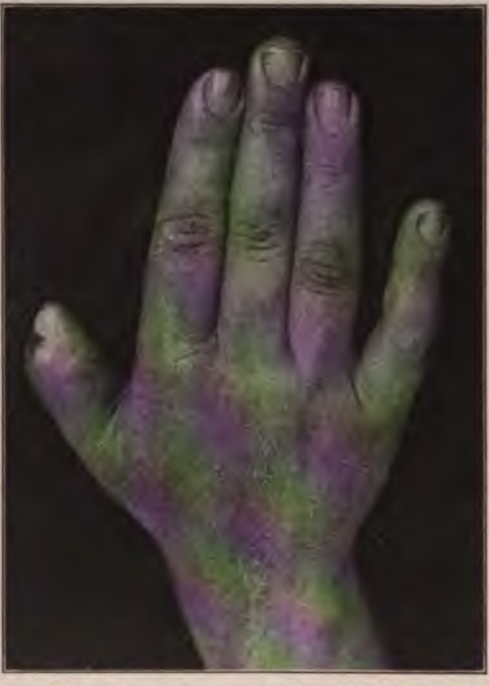

FIG. 188.—SAME SUBJECT AS FIG. 187. Recovery with no loss of bone, but the skin was so tightly stretched over the distal phalanx that its tip was later resected.

For the treatment of cellulitis see page 402.

Cellulitis in the hand does not often lead to gangrene, even when it develops in diabetics or individuals otherwise enfeebled. Yet it may do so. Hence, the necessity for free incisions whenever swelling within the restricting skin of the finger threatens to cut off the circulation from the damaged part. Figure 192, on page 403, shows a finger which was lost by neglect of this precaution. Such gangrene is moist.

Whenever a cellulitis which is well drained does not progress satisfactorily, and gangrene is threatened, the urine should be examined for sugar and albumin. If either is present the treatment should be prompt and radical, as delay in amputating a finger under such circumstances may lead to loss of an arm later, or possibly of a life. Gangrene due to diabetes or nephritis is far more common in the foot than in the hand. (See Chapter XVIII.)

INFLAMMATIONS

Infection in Wounds.—Although the hand is exposed to frequent injuries, large and small, repair usually takes place without inflammation sufficiently marked to demand surgical treatment. Such inflammation as does occur usually follows a punctured wound, or a wound into a preformed space, such as a joint or bursa or synovial sheath. The very fact that the wound is small favors the early closure of its mouth, and then, as the introduced germs multiply in it, they find it easier to penetrate the deeper tissues than to escape to the surface.

The form and extent of the inflammation are determined by the nature of the wound, by the nature of the introduced germs, by the health of the individual, etc. We shall consider here only the forms which occur with frequency in the upper extremity. There are clinically seven such forms, the lesions in four being chiefly local, that is in the immediate vicinity of the wound; while in three they are chiefly regional, developing at a distance from the wound in structures which are associated with the wounded part by means of the lymphatics.

These four types of local inflammation are anatomical tubercle, acute dermatitis, cellulitis, and abscess; and the regional forms are lymphangitis, lymphadenitis, and secondary abscess. These forms of inflammation are variously combined, but one or the other type usually predominates in any given case. It is not safe to infer from the form taken by the inflammation that it is due to a certain germ, for, according to Welch, "all of the affections caused by one species of the pyogenic cocci may be caused by any of the others."

Anatomical Tubercle.—This is an old term used to describe the reaction in wounds in the dissecting-room, which were common before the use of antiseptics. The term is still of use to describe a form of inflammation without suppuration limited to the immediate vicinity of the wound, lasting many days, and terminating in resolution, without or with a local necrosis of the skin (Fig. 189). This wound, as all others, may be the starting-point for a more wide-spread inflammation. Anthrax (Fig. 79, p. 132), syphilis (Fig. 215, p. 436), and tuberculosis all form similar lesions, so that a bacteriological examination should be made, if possible.

Anatomical tubercle should be treated by wet dressings. If a malignant character of the infecting organism is proved or suspected, the tubercle should be excised.

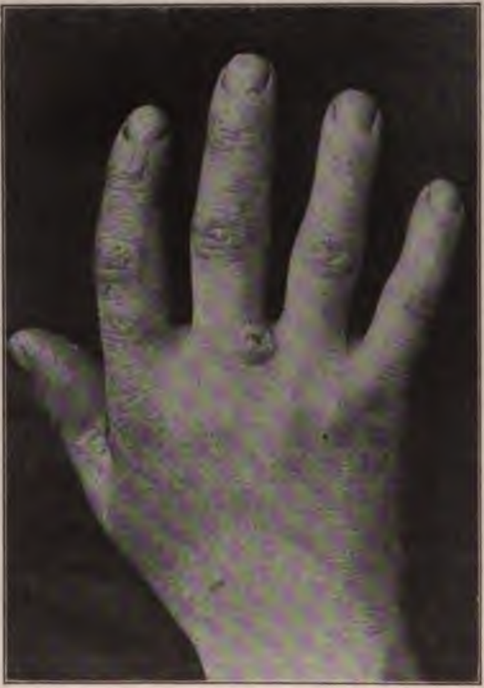

FIG. 189.—ANATOMICAL TUBERCLE, DURATION ONE WEEK. The patient was a butcher, aged twenty-two years.

Dermatitis; Erysipelas. — Dermatitis produced by germ invasion is marked by edema, redness, tenderness, and pain, and a constant daily extension of the involved area. Erysipelas is the typical dermatitis of this character. It spreads rapidly, often as much as an inch a day, more rapidly in the direction of the lymph current than against it. It may also be known by the general symptoms of an initial chill and a high fever, but as a rule the symptoms are less severe when the erysipelas occurs on an extremity than when the face is involved. Moist antiseptic dressings, applied and allowed to evaporate, give the patient some relief from the pain, but they do not seem to have much effect upon the spread of the dermatitis. Fortunately, the inflammation tends to become less and less active the further it spreads, and so gradually dies out, and the patient recovers. In a minority of cases the inflammation extends to the deeper tissues, producing cellulitis, lymphangitis, and abscesses, which may prove fatal.

A good application is formalin, one per cent solution, or a solution of carbolic acid one part in sixty parts of alcohol and sixty parts of water. This is weak enough not to produce gangrene, and the anesthetic action of the carbolic acid is advantageous. (See also erysipelas of the face, p. 35.)

Erysipeloid.—An equally typical infective dermatitis occurs on the hands of those engaged in handling meat. It is often spoken of as an erysipeloid to distinguish it from the more active erysipelas. It does not usually produce an initial chill, and is accompanied by only a slight rise in temperature. There is redness and edema of the skin, with a distinct edge to the affected area, which spreads outward in all directions very slowly, averaging one-quarter of an inch a day (Fig. 190). There is considerable local pain, sufficient at times to disturb sleep. After a few days the infection dies out in some parts of its growing edge, while still advancing in others, so that it terminates in a number of separated and somewhat faded red spots, which gradually disappear in two or three weeks. Treatment consists in applications to relieve the pain. Ichthyol ointment has some advantages.

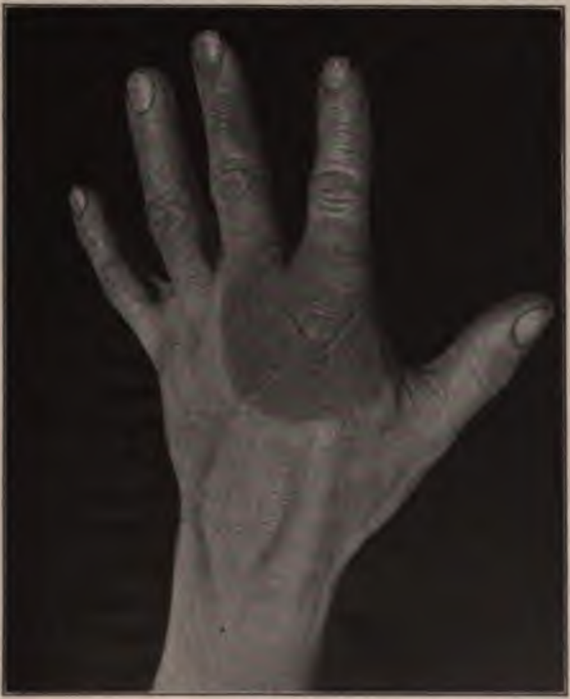

Fig. 190.—Erysipeloid Dermatitis Developing in a Wound of Hand of Seven Days' Duration. Erysipeloid dermatitis noticed for three days. Patient a butcher aged twenty-one years.

Cellulitis.—Cellulitis is a diffuse swelling of the skin and deeper soft tissues, due to infection. The lines of the skin are obliterated, the outline of the part is changed, its functions are limited, and it is held in a position of relaxation so that the painful pressure upon inflamed nerves may be as little as possible (Fig. 191).

Cellulitis is so often an accompaniment of an abscess that in every case of cellulitis search should be made for suppuration. It may be concealed under the dried crust of an abrasion. A small collection of pus beneath sound skin gives greater resistance to the palpating finger than the remainder of the inflamed area, and it is also much more tender to the touch. If the quantity of pus is larger and near the surface, fluctuation can be obtained by making sudden slight impressions with one finger, while another rests quietly upon the suspected surface. Pus also gives a whitish or yellowish tint to the skin over it as compared with the surrounding skin. This is a confirming sign, which sometimes appears early enough to be of value to the surgeon, and which convinces the patient as no other sign can, that the abscess is "ripe enough to cut."

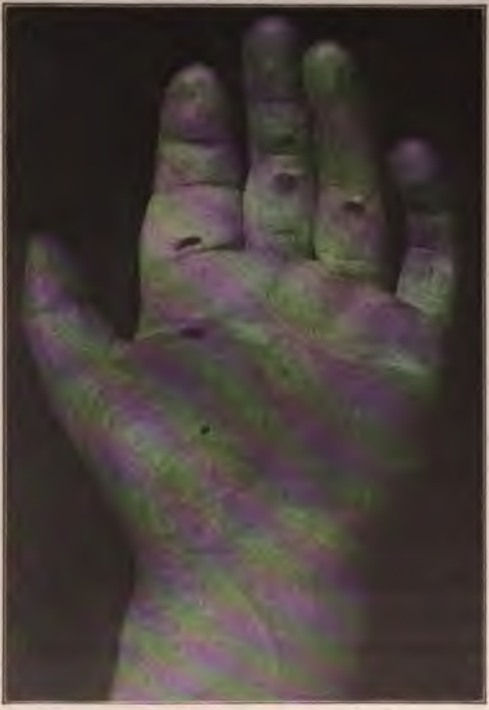

FIG. 191.—CELLULITIS OF FINGER WITH ABSCESS OF SIX DAYS' DURATION. Patient a man aged thirty-one years.

TREATMENT.—Cellulitis of the hand or arm should be treated by the application of gauze wet with an evaporating lotion, and the part should be kept at rest and moderately elevated by means of a sling. Evaporation should not be prevented by oiled silk or any impervious material. The effect of the fluid is greater if it contains some alcohol. It may be applied either hot or cold. The use of antiseptics in the fluid is very common, but probably has no effect whatever if the skin is not broken. The fluid chosen should not produce permanent stains on the clothing; for this reason lead and opium wash, and aqueous solutions of ichthyol are not to be recommended.

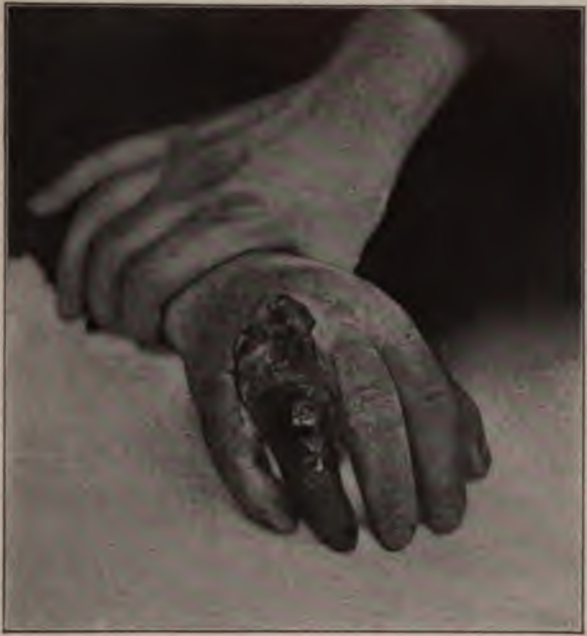

FIG. 192.—GANGRENE OF FINGER FOLLOWING CELLULITIS, AND APPARENTLY DUE TO UNRELIEVED TENSION. The details are stated in the text.

If pus is present it should be evacuated through a suitable incision, as mentioned below. The best signs of pus are local tenderness on pressure, and increased local tension. Even if there be no visible collection of pus, marked increase of tension and pain are sometimes sufficient indications for incision. Thus, the gangrene of the finger shown in Figure 192 might have been avoided by an early incision. The history of this case is so instructive that it is worth giving in detail.

A healthy man, aged thirty-two, scratched the back of his fourth digit with the wire on a bale of hay. For five days he noticed no especial change in the finger. Then it began to swell, and he presented himself for treatment on the ninth day. There was moderate cellulitis of the whole finger, with puffiness at both pharyngeal joints, but no especial tenderness at any point. A wet dressing of aluminum acetate was applied. The next day the finger was in about the same condition. The patient had slept well, had a good appetite, and little if any fever. The wet dressing was reapplied. The next day the condition was about the same. The question of incision was discussed and decided against for the reason that the process was not extending, there was no lymphatic affection either in the vessels or glands, the general health of the patient was undisturbed, and no local point of tenderness or fluctuation could be made out. The following day was Sunday, and the patient was not seen. On Monday the epithelium, anteriorly and posteriorly, was lifted by watery blebs and the underlying skin of the finger was discolored, although there was no sharp line of demarcation. There were still no constitutional symptoms, and, no cause for gangrene being evident, the hand was again dressed and put on a splint. The next day there was fluctuation in the posterior tendon sheath, and the demarcation between living and dead tissue was more apparent. The photograph, of which Figure 192 is a reproduction, was taken; the pus was evacuated through a wide posterior incision, and the inflammatory process rapidly subsided. No carbolic acid had been used; the infection, as shown by its course and by cultures made from the pus, was not especially virulent, and one is forced to the conclusion that the gangrene of the finger was the result of excessive tension and that an early longitudinal incision made anywhere through the skin of the finger, by relieving this tension, might have avoided this gangrene.

Boil; Furuncle.—Suppuration in the arm and hand is somewhat controlled by existing structures so that it presents several well marked forms. The pus may be in the skin in the form of a pimple or a boil (Fig. 193). These lesions may have the same characteristics as similar lesions in other parts of the body, but it is worth noting that the epidermis of the palmar surface of the fingers and hand is so thick that pus may collect in it, raising the superficial portion like a blister. This is insensitive and can be cut away with forceps and scissors, exposing the deeper layer of epidermis. This should be sponged and inspected, for it often contains a sinus leading to a second abscess underneath the skin, the so-called "collar button" abscess. For the opening of the deeper part of such an abscess, local anesthesia is required. Great care should be taken not to carry the incision beyond the abscess cavity so that operation may not spread the infection beyond its existing limits. (See also p. 411.) A small wick of gutta-percha tissue makes an excellent drain.

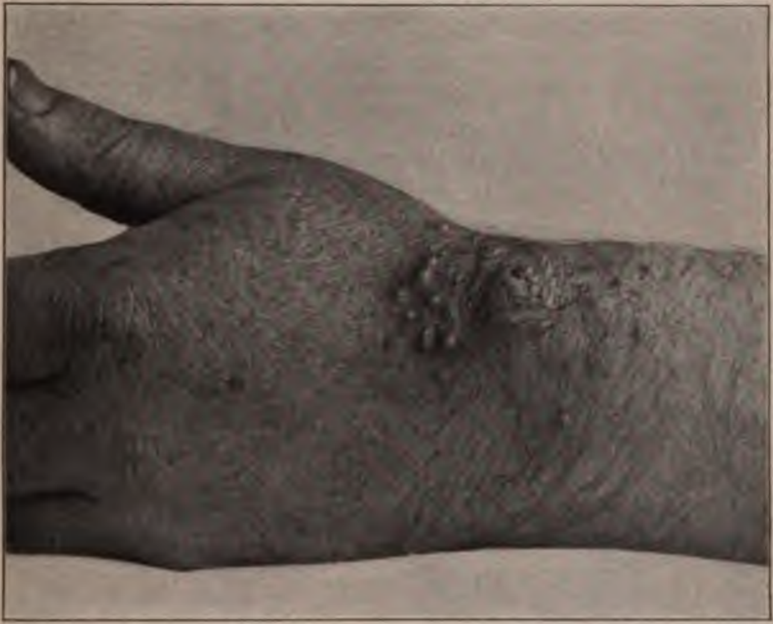

FIG. 193.—BOIL OF WRIST WITH SECONDARY PIMPLES. Original infection from a corpse; secondary infection from the discharge from the first boil.

When the pus is situated in a finger deeper than the true skin, the development of the abscess will be determined to a considerable extent by the peculiar anatomical relations which exist in the fingers, and especially in the finger-tip. Figure 194 shows in a diagrammatic way how pus may form in four different spaces, and the symptoms will be more or less different in each case. These four spaces are: *A*, the space between the dorsal skin and the matrix; *B*, the space between the matrix and the formed nail; *C*, the space between the formed nail and the underlying skin;

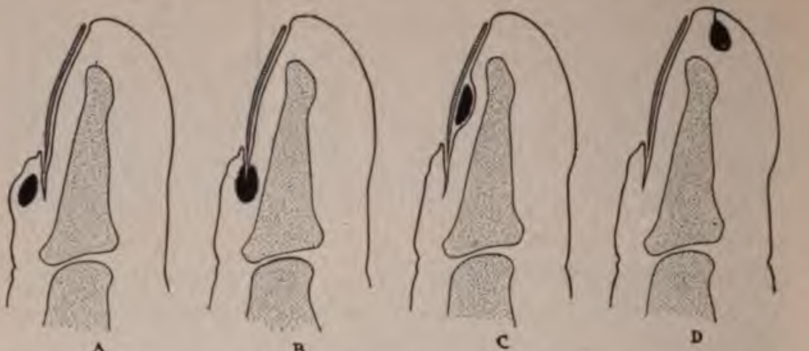

FIG. 194.—SECTION OF TERMINAL SEGMENT OF FINGER. An abscess may form between the dorsal skin and the matrix of the nail at *A*; or between the matrix and the formed nail at *B*; or between the nail and the underlying skin at *C*; or between the skin and the front of the phalanx, as shown in *D*.

and *D*, the space between the skin and the front or side of the phalanx. These are not preformed spaces, but with the development of pus in the tissues they become abscess cavities.

An abscess of the type *D* usually following a prick with a pin or splinter, situated in the distal segment of the thumb or finger, may "point" at the very tip of the finger. If not properly relieved it may extend deeper, causing necrosis of the tip of the last phalanx, or it may extend upward into the hand or into the flexor tendon sheath. Fortunately these complications are relatively late in occurrence, so that if the abscess is drained within a few days of its origin they are usually avoided. The flexor tendons do not extend further than the base of the distal phalanx; consequently suppuration which is limited to

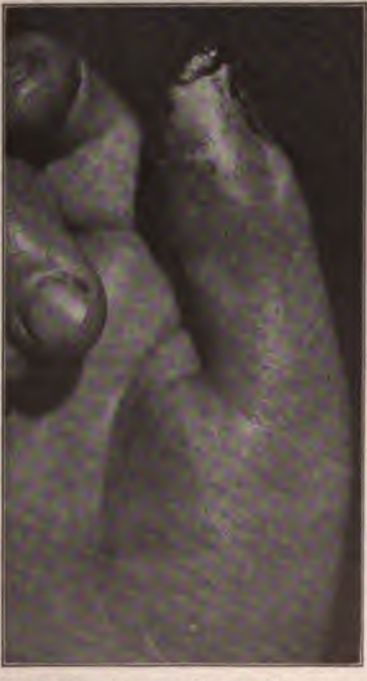

FIG. 195.—ABSCESS TIP OF THUMB OF THIRTEEN DAYS' DURATION, WITH SPONTANEOUS RUPTURE; TYPE D, FIG. 194. Note that the swelling does not pass the interphalangeal joint.

the distal segment of the digit cannot involve the tendon sheath; yet this type of suppuration is often wrongly spoken of as a "felon," a convenient term for purulent thecitis or suppuration in a tendon sheath. Fig. 195 shows a thumb with an abscess of type *D* of thirteen days' duration, which ruptured spontaneously.

Abscesses of types *C* and *D* should be opened by a transverse incision at the tip of the digit, following one of the natural lines in the skin. This incision gives good drainage, and leaves far less deformity than a longitudinal incision. The nail should not be removed.

Paronychia.—Paronychia, or "run-around," is suppuration about the root of a nail. In order to understand its development and the treatment which will afford relief, one should know how a nail grows. The epithelium of the back of the finger is folded in upon itself and thickened. This double layer of actively multiplying cells reaches nearly to the terminal joint, and is called the matrix of the nail, Figure 194, *C* and *D*. The lower part of the matrix is thicker than the upper and forms the greater part of the nail. The distal edge of the underlying part of the matrix forms the whitish semilunar line visible in most finger-nails. A nail which is thick and strong, like the thumb-nail, has a more extended matrix than the more delicate nails on the ulnar side of the hand.

If a splinter or a pin passes between the nail and its matrix, above or below, the tissues are damaged, blood and serum collect in the wound, and an abscess may result. Such an abscess may result from infection entering through a break in the skin at the side of the nail—a hang-nail. The pus will at first be confined between the half formed nail and its matrix, and it will spread more easily transversely than in any other direction; but before much pus accumulates in the situation *B*, Figure 194, it will also travel beyond the matrix and enter the space *C*. The reverse also happens, but the space *C* is much larger and an abscess starting beneath the nail in *C* is often some distance from the proximal edge of the nail. The spontaneous rupture of a paronychia is usually posteriorly between the nail and the reflected skin (Fig. 196). The drainage thus obtained is not sufficient to effect a cure, but usually prevents the suppuration from extending to the front of the finger, or upward into the hand, though these complications do occur.

TREATMENT.—This naturally varies according to the situation of the pus. If the pus is beneath the formed nail, a sufficient part of the latter should be cut away to give free exit. Such a condition often follows the passage of a splinter beneath the nail, even though it does not extend as far as the edge of the matrix.

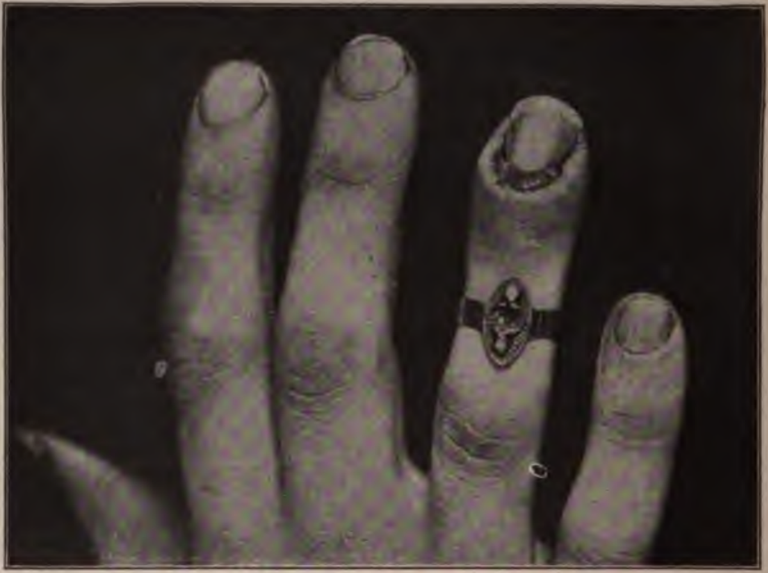

FIG. 196.—ACUTE PARONYCHIA OF THREE WEEKS' DURATION, WITH SPONTANEOUS RUPTURE OF ABSCESS. Pus in spaces marked *A* and *B*, Fig. 194. Patient a woman aged twenty-one years.

If the pus is in space *B* and has not yet extended to space *A* a transverse incision should be made through the reflected skin the whole width of the nail. In doing this the scalpel should be kept flat upon the nail and close to it, so that the incision does not appear on the surface of the finger at all. In many cases it is no incision at all, simply a bloodless separation of the nail from the posterior part of the matrix.

If the pus is in the space *B*, reaching toward *C*, a transverse incision should be made clear across the nail at the semilunar line, and the proximal portion of the nail removed. It will be found adherent only at its lateral margins. If the distal portion of the nail is still attached to the tender skin beneath it, it may be left as a protector. In many cases it will have been lifted up by the pus. The upper and lower portions of the matrix should be kept apart for two or three days by a folded piece of rubber tissue, and a wet dressing applied.

A longitudinal incision is less satisfactory, since it does not properly drain the pus cavity. Multiple longitudinal incisions have been advised by some, but they are unnecessarily mutilating, and require constant care, lest they close prematurely and fail to drain. Moreover any longitudinal incision which is made deep enough to pass through the whole matrix is likely to produce a permanent ridge in the nail or a split nail. Drainage carried out as indicated above will invariably be followed by a perfect nail.

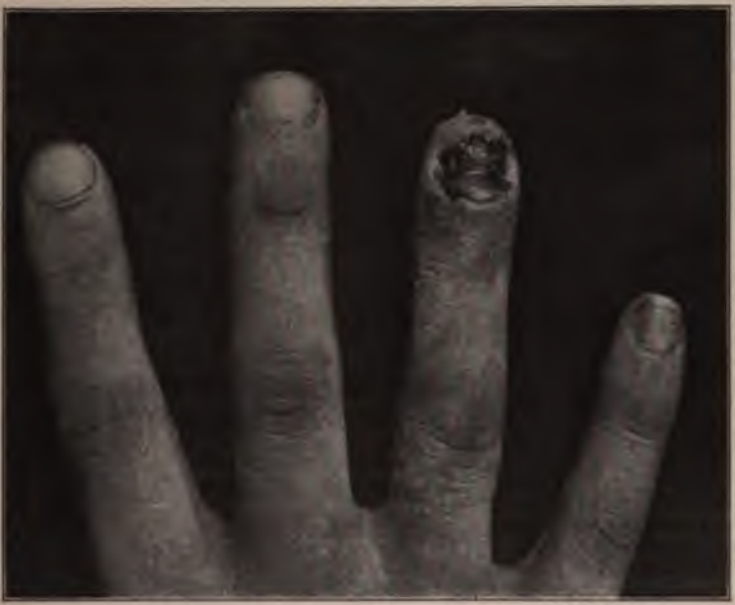

FIG. 197.—ACUTE PARONYCHIA TEN DAYS AFTER REMOVAL OF OLD NAIL, AND ONE MONTH AFTER THE BEGINNING OF THE SUPPURATION. Same subject as Fig. 196.

Figure 197 shows the finger ten days after removal of the nail to secure proper drainage. All suppuration has subsided, and the uninjured new nail is already showing.

If drainage is secured as already indicated by removal of the proximal portion of the nail, while the older portion is left to protect the finger, the new nail by its growth must push the old nail off from the finger. Its thin edge may be crumpled up by so doing, and this may cause the patient some pain. The removal of the remnant of the old nail will give the patient relief, and make it easier for the new nail to grow out smooth and straight. The tenderness of the finger resulting from removal of the old nail quickly subsides.

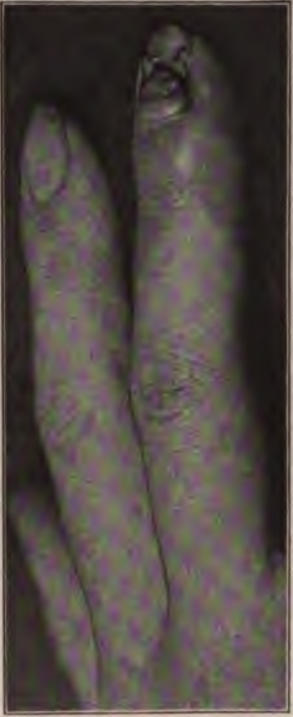

FIG. 198.—CHRONIC PARONYCHIA, FOUR MONTHS. Note that the edges of the old nail interfere with the new, leading to local recurrences of suppuration. Patient a woman aged twenty-two years.

Chronic Paronychia.—Portions of formed nail, which are partly loosened and partly attached, may act as foreign bodies and keep up suppuration. This gives a chronic form of paronychia (Fig. 198). Treatment consists in the removal of every bit of formed nail and the application of a wet dressing for a few days. The two layers of the matrix should be kept apart by the interposition of rubber tissue, or a probe may be passed between them every two or three days until the new nail appears. This method of treatment will insure a nail without deformity unless the matrix has been previously damaged.

A patient will usually wish to know how long it will be before the appearance of the finger is restored. It is safe to say that it will be three months before the new nail grows out to the tip of the finger, and at least another two months before the irregular part of the new nail has grown off and has been cut away.

There is still a fifth type of suppuration in the last segment of the finger. This type of suppuration often starts in a torn "hang-nail," and is situated generally at the side of the finger.

It may be drained through an incision made by keeping the knife flat on the nail, or else by a longitudinal incision made through the skin. The latter is parallel to the natural lines of the skin at the side of the finger.

Suppuration in the proximal or middle segment of a finger may be simply subcutaneous, or in a tendon sheath, or in a joint. It is of the greatest importance to recognize the fact that many abscesses of the finger are simply in the subcutaneous fat, and do not involve the special structures of the digit. In opening such an abscess the skin only should be divided, great care being taken not to spread the suppuration by the careless incision of a hitherto not infected tendon sheath or joint. If the situation of the pus warrants it, it is best to make the incision a little to one side of the median line.

Suppurative Thecitis.—Suppuration in a tendon sheath is called purulent thecitis, or felon, or whitlow. The infective agent,

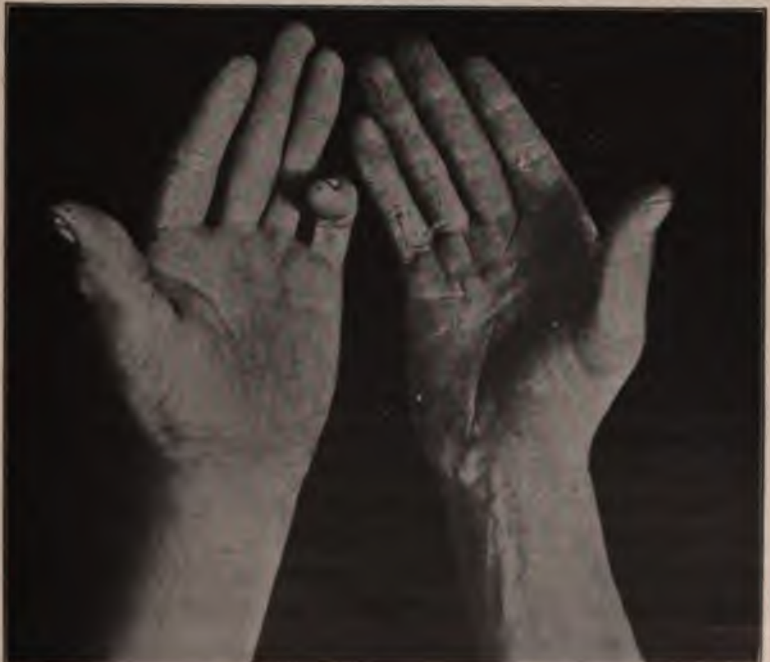

Fig. 199.—Abscess in the Tendon Sheath of the Thumb from a Splinter, of Two Weeks' Duration. Compare the shape of this thumb with that shown in Fig. 195 on page 406. Fifth digit contracted thirty-five years from infection. Patient a man aged forty years.

which in the serious cases at least, is usually a streptococcus, is generally carried by a pin, needle, or sliver into the tendon sheath of the flexor side of the finger or thumb (Fig. 199). Suppuration does not immediately distend the whole length of the sheath, so that a timely incision may prevent its spreading so far as the palm of the hand. Its extension from the tendon sheath of one digit to that of another is rarely seen, although mentioned as an anatomical possibility in the case of the thumb and little finger.

The symptoms of suppurative thecitis may not be sufficiently distinct to enable one to say positively whether the pus is inside of the tendon sheath or merely subcutaneous. This distinction is the less important, since in either case it is necessary to divide the skin for drainage, and when this has been done it will be evident whether the sheath is or is not distended with pus.

In both cases there are edema of the finger, great tenderness, and possibly tense fluctuation. Motions of the joints are inhibited by the tenderness, so that the inability of the patient to flex the finger is not of much assistance in a differential diagnosis. Pain caused by contraction of the flexor muscles when the finger is so held that no motion of the bones is possible, is significant of suppuration within the sheath. If there is pus in a joint, pressure on the tip of the finger will cause pain. If the pus is inside or outside of a tendon-sheath, such pressure will not be especially painful.

TREATMENT.—Pus in a tendon sheath, like pus everywhere else, demands evacuation. In general, incisions for this purpose should be longitudinal, in order to avoid unnecessary injury of vessels and nerves; and while the incision should be deep enough and long enough to afford free drainage, in no case should it be made deeper than the pus. The old rule to cut every felon to the bone is a barbarity which has no place in modern surgery.

The close relations of the tendon sheaths to many important structures in the hand makes it desirable that some more exact rules should be given for their drainage. In every case of suppuration in the hand, unless it is evident that the case is one of the simple types already described in which the pus cavity is situated within or just beneath the skin, a general anesthetic should be given. Furthermore the parts should be rendered bloodless by elevation of the arm and application of a tourniquet around the upper arm. The best form consists of five or six turns of an elastic rubber bandage. In no case should the bandage be wound spirally around the whole arm from the hand upward, lest the suppuration be spread in this way.

The first incision should be made through the point of infection. Even if a previous incision has been made at that point, it will often be found to be insufficient to afford free drainage. If the case is seen at an early stage, this digital incision may suffice.

In making the incision one should divide one tissue plane after another for a distance of about an inch. As each plane is divided, it should be fully retracted, so that the operator may see exactly what he is doing.

It is important to remember that in some cases of deep suppuration of the finger, as well as of the hand, the pus lies outside of the tendon sheath. One should never hunt for pus with a probe, in this portion of the body at least, as it may spread the infection. When an abscess has been opened, its extent may be determined by a probe, provided the latter is not passed into the tendon sheath.

If incision is made in the finger or the thumb, it should be made either in the median line or slightly to one side of it. It should be carried deeper, step by step, with the flaps retracted, in a good light, until the pus is evacuated. If the tendon sheath is exposed and is not distended with fluid, it should in no case be incised. If it is distended with fluid, the character of the same may be ascertained by aspiration with a hypodermic syringe. If purulent or seropurulent, the tendon sheath should be drained by an incision from half an inch to an inch long.

If the whole tendon sheath is distended with pus, it will be necessary to drain also its upper end. Incision for this purpose in case of the index, middle, and ring fingers should be made in the palm of the hand directly over the tendon involved. An incision about one inch long, with its center opposite the metacarpophalangeal joint will usually suffice (Fig. 200, *D*). The tendon sheath should never be laid open from end to end, as this procedure is almost certain to cause sloughing of the tendon.

One word of caution in regard to palmar suppuration: The tendon sheath of course lies beneath the palmar fascia. This limits the swelling of the palm. On the back of the hand there is no such strong fibrous tissue to limit swelling, and it sometimes happens that the back of the hand will be more swollen than the front, although the suppuration may be wholly confined to the space between the metacarpal bones and the palmar fascia.

One should not be misled by this swelling into making a posterior incision, for at this stage of the process posterior incision is useless. Such was the series of events in the case shown in Figures 200 and 201. The patient, a nurse, noticed a soreness in the end of the left index-finger. There was no history of injury, and no abrasion in the skin could be discovered. An hour later the finger began to ache and throb. Two hours after that there was a chill and a temperature of 102, and the pain had extended into the hand and arm. Five hours after the first symptom the finger was tense, swollen, and extremely sensitive,

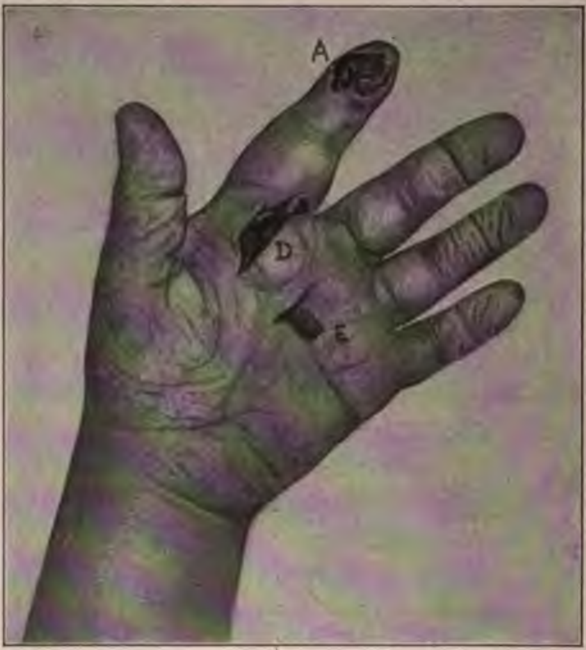

FIG. 200.—SUPPURATION IN THE INDEX-FINGER EXTENDING INTO THE PALM (PURULENT THECITIS). *A*, The point of infection and the original incision, probably insufficient in depth; *D*, incision at the upper end of the tendon sheath which stopped the infective process; *E*, an incision into the abscess cavity outside of the tendon sheath. There are small drains in incisions *D* and *E*. Patient a woman aged twenty-five years.

and there was a small yellow spot near the tip on the palmar surface. It was cocainized and incised by a physician, but no pus was found (Fig. 200, *A*). A wet dressing was applied. The following day the swelling had extended to the hand and arm, and the general symptoms were more severe. On the second day after the first symptoms another physician chloroformed the patient, and made a lateral incision in the finger and a posterior incision in the hand, being misled by the great amount of swelling in these two places. Cloudy serum, but no pus was found (Incisions *B* and *C*, Fig. 201). Two days later, as the swelling in the hand and arm continued, I saw the patient, and under ether made a palmar incision into an abscess cavity (Incision *D*, Fig. 200), and also a second incision at the outer limit of the abscess cavity (Fig. 200, *E*). There seems no reason to doubt that the palmar incision would have terminated the suppuration if it had been made on the second day, just as readily as it did when it was

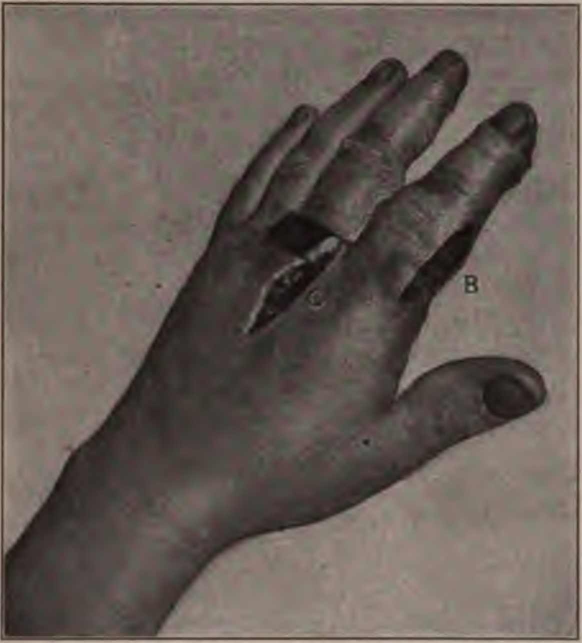

FIG. 201.—SAME SUBJECT AS FIG. 200. Posterior view. Incisions *B* and *C*, which failed to reach the cavity of the abscess on account of their wrong situation. The drain at *C* extends through the hand from *D*.

made on the fourth day. A temperature chart is appended, Figure 202.

The photographs, which were taken some days later, do not show the amount of swelling that existed at the time of incision, and are introduced to show the correct and incorrect sites of incision. The suppuration at the tip of the finger involved the bone, a part of which disintegrated and came away in granular form. The ultimate result is shown in Figure 203. The patient obtained a movable finger.

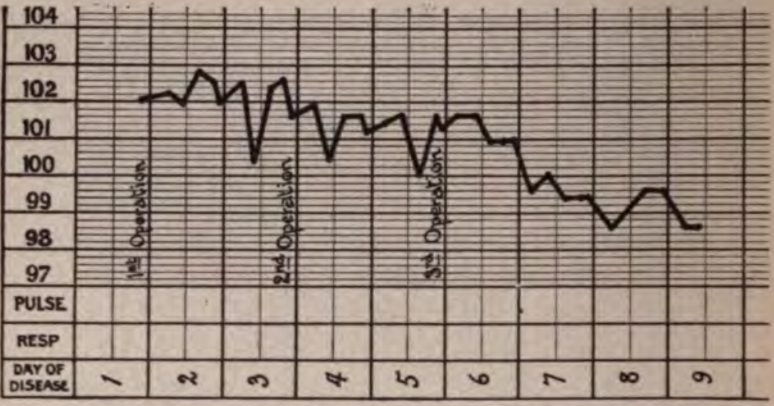

Fig. 202.—Temperature Chart of the Patient Whose Hand is Shown in Fig. 200.

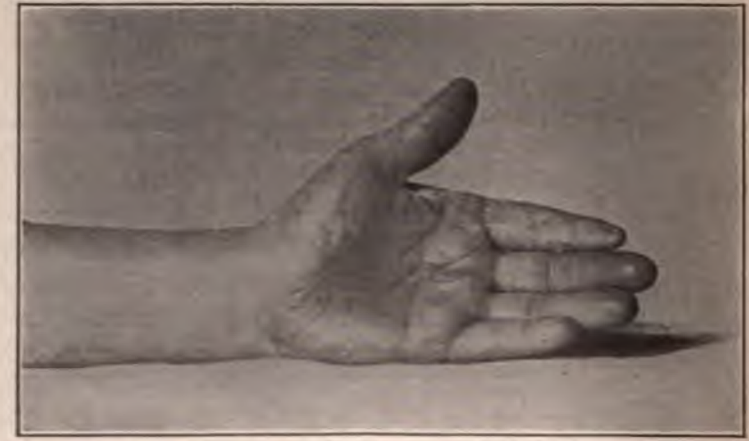

Fig. 203.—Same Subject as Fig. 200. Ultimate result three months later.

In case the suppuration involves the tendon sheath of the thumb or little finger, the situation is much more complicated, since these tendon sheaths usually extend into the wrist.

Three incisions may therefore be necessary to afford sufficient drainage: First, the digital incision at the point of infection, usually near the tip of the thumb or little finger; second, the incision in the palm; and third, the incision in the wrist.

In the case of the thumb, the palmar incision should be made along the inner border of the outer head of the flexor brevis pollicis. This incision is almost in line with the inner surface of the thumb when the first phalanx is fully extended on the metacarpal bone. It should not be carried further upward than the second carpometacarpal joint, for fear of dividing branches of the median nerve going to the short muscles of the thumb.

The incision in the wrist may be made either to the inner or outer side of the tendon of the flexor carpi radialis, a landmark which is easily recognized. It should extend from the lower transverse crease of the wrist an inch or inch and a half upward. One comes more directly upon the tendon of the thumb by making the incision to the inner side of the flexor carpi radialis, but drainage in this situation sometimes inflames the median nerve. It is therefore probably better to make the incision outside of the tendon of the flexor carpi radialis, and if the radial artery is exposed to contact with the drain, it should be ligated in two places and divided. Otherwise its wall may become eroded, and fatal hemorrhage result.

When the infection starts in the little finger, the palmar incision should be placed between the digital branches of the median and ulnar nerves. In order to avoid these nerves, it should be made directly over the fourth metacarpal bone, beginning a little above the head of the bone and extending upward to the annular ligament. The superficial palmar arch must be ligated and divided.

The incision in the wrist must be so situated as to expose the flexor sublimis and flexor profundus tendons, as the pus surrounds or separates these when it extends above the annular ligament. This large bundle of tendons is easily felt in the normal wrist. The incision should be along the inner border of the bundle. If the tendons cannot be felt, a linear incision should be made from the lowest transverse crease of the wrist upward for an inch and a half, and in a line one-half inch to the outer side of the tendon of the flexor carpi ulnaris. This tendon, it will be remembered, terminates in the pisiform bone. If even these landmarks are obscured, the line selected for incision should be placed one-third of the distance from the ulnar to the radial side of the wrist. The sublimis tendons are quickly exposed. Pus may lie superficial to them or between them and the profundus tendons, or between the profundus tendons and the pronator quadratus. If the pus is in the last named space, it may be well to make a second incision along the ulnar border of the wrist, so as to obtain drainage behind the tendon of the flexor carpi ulnaris. The only two structures which one need fear in making these incisions are the ulnar nerve and the ulnar artery. The nerve lies close to the outer (radial) side of the flexor carpi ulnaris tendon and the artery just outside of the nerve, next to the sublimis tendons. The artery may be divided and ligated, if necessary.

As stated above, the tendon sheath should never be opened if the pus lies only outside it. If the sheath has to be opened on account of pus within it, no probe or director should be pushed upward along the sheath, lest it carry the infection further than it has already gone. The operator should rely on the external appearance of the finger, on the feeling of tension, and the pain caused by pressure to guide him in making his incision. When the pus cavity has been opened, and the edges of the wound are retracted, the eye is the safest guide to the extent of the cavity; but there is not the same objection to the use of a probe in abscess cavities which extend away from the tendon sheath. Such cavities, especially when situated near the base of the finger and outside of the tendon sheath, frequently extend from front to back, or from back to front of the finger, and so need to be opened on both sides in order to be properly drained.

The abscess cavity should be washed and sponged clean, but not curetted—a most cruel procedure and absolutely useless. The whole extent of the wound superficial to the tendon sheath should be lightly filled with gauze to prevent its surfaces from adhering. A gauze dressing should be applied and kept constantly moist with a mild antiseptic or water. Some doctors seem to have a passion for stuffing a wound full of iodoform gauze and covering it with a dry dressing. In the case of a clean wound this does very little harm; in a suppurating wound, unless the outflow of pus is very free, the plug may suffice to keep most of the pus within the wound, while a little escapes and dries in the dressing. This may seal up the wound and literally reproduce the abscess, one side of which will then be formed by the gauze and inspissated pus. Pus will then reaccumulate under pressure, and the usual signs of an abscess—swelling, heat, pain, etc.—will reappear. It is needless to say that such treatment retards the healing of the wound, even if no more serious result follows. If the gauze is placed loosely in the wound, and the dressing is kept constantly moist, the pus will soak into the dressing as fast as it forms. Its accumulation under pressure is impossible, and the absorption of further infectious material is at least not favored.

If drainage is required in the deeper portion of the wound, gutta-percha tissue presents many advantages. Being more flexible than rubber-tubing, it conforms to the shape of the wound, and therefore exerts a minimum of injurious pressure. Unlike gauze, it never adheres to a wound, and as it does not soak up the discharge, it cannot by evaporation become dry and prematurely seal the wound. If it is desired to keep a larger opening, the gutta-percha tissue may be rolled loosely around a wick of gauze, making a flabby cigarette drain (Fig. 306).

The part should be kept at rest. If the inflammation is slight, it is sufficient to place the hand in a sling. If the inflammation is more severe, a splint should also be employed.

The hand should be dressed once or twice a day. A good plan is to soak it in a hot, weak, antiseptic solution for half an hour, before or after removing the dressing. This stimulates the circulation, and greatly favors the exit of pus. If irrigation is employed, the fluid used should be mild in character, and injected with great gentleness. One should never use a strong solution of peroxid of hydrogen, as the rapidly forming bubbles of gas distend the sinuses, causing the patient pain, and possibly spreading the infection. One part of peroxid to six of water is sufficiently strong for such use. An abundance of a weak fluid is a far better cleanser than a little strong antiseptic.

In most cases nothing is gained by an early removal of the gauze which has been placed in the wound. Unless there are signs of insufficient drainage, i. e., continued or increasing swelling, tenderness and heat, it is better to leave the gauze packing for three or four days until it loosens. As granulations form, the dressing need not be changed so frequently, and in a week or more a balsam of Peru gauze may be inserted, and a dry dressing employed. When the wound has become superficial, massage and passive motions should be added to the treatment, so as to maintain the mobility of joints and tendons.

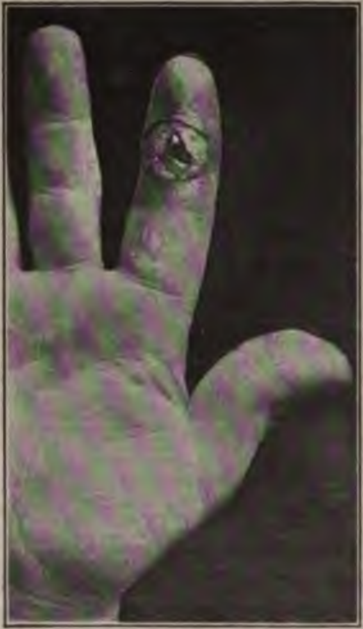

FIG. 204.—SUPPURATION IN TENDON SHEATH FOUR WEEKS. Drainage sufficient to reduce the swelling, but not to effect a cure.

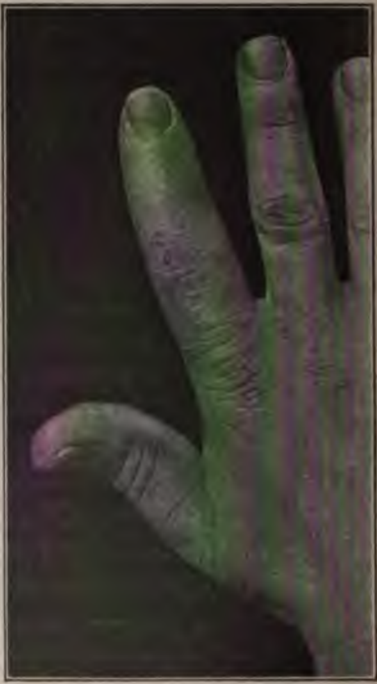

FIG. 205.—BACK OF SAME FINGER. Note the absence of characteristic swelling.

Sometimes the patient does not apply for treatment until the abscess in the tendon sheath has ruptured externally, or has been evacuated through a minute incision. This relieves the acute swelling (Figs. 204 and 205), and changes the shape of the finger, as is easily seen by comparison with Figure 191, page 402, but leaves an imperfectly drained sinus. Proper drainage may then be obtained by a longer incision or a second incision opposite the proximal phalanx.

Complications.—Suppuration in a tendon sheath if not too violent or too long continued may subside and leave a movable tendon. If more severe, the tendon is adherent, but will usually become movable in time. If the process is still more severe, the tendon sloughs, the wound heals by granulation, and the scar ultimately contracts, giving a useless finger, whose joints are movable, but which cannot be flexed, as the flexor tendon is gone, and cannot be extended on account of the scar. This was the condition of the little finger in the hand shown in Figure 199, on page 411. If such a finger is in the middle of the palm its flexed phalanges should be amputated (Fig. 206). If a finger remains rigidly extended, it is almost as much in the way.

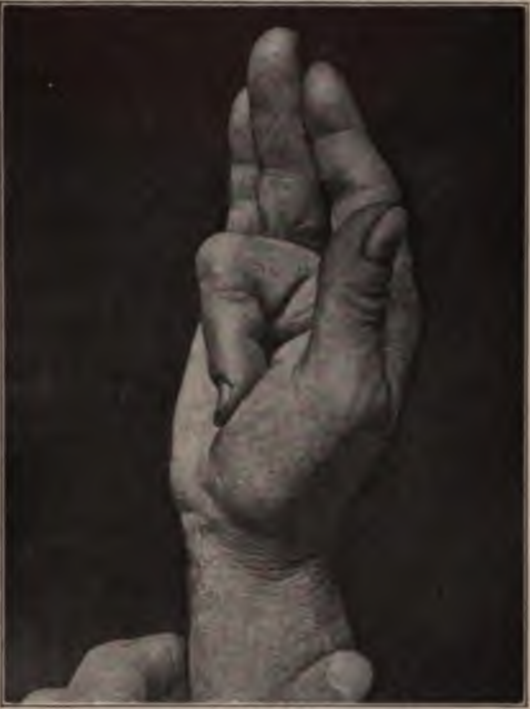
Fig. 206.—Cicatricial Contraction of Finger Following Suppuration in Tendon Sheath Twenty-five Years Previous. Joint movable, but tendon gone.

The results of an old infection of the hand, which involved all the extensor tendons, is shown in Figure 207. The ulcer is recent.

A virulent infection of a tendon sheath may lead to necrosis of bone, or even gangrene of the whole finger, but before it does so it usually extends to the synovial sheaths of the hand and wrist, or to the joints, and it may form an abscess in the forearm or axilla, or go on to general septicemia and death.

If the infection extends above the wrist, it may form an abscess in the forearm, beneath the bellies of the flexor sublimus muscle. Such an abscess should be opened along the ulnar border of the forearm, between the flexor carpi ulnaris and the flexor sublimus digitorum muscle. In this way all risk of injuring the median nerve is avoided. The ulnar nerve is protected by the flexor carpi ulnaris muscle. Should the ulnar artery be injured, it may be ligated and divided without harm to the patient.

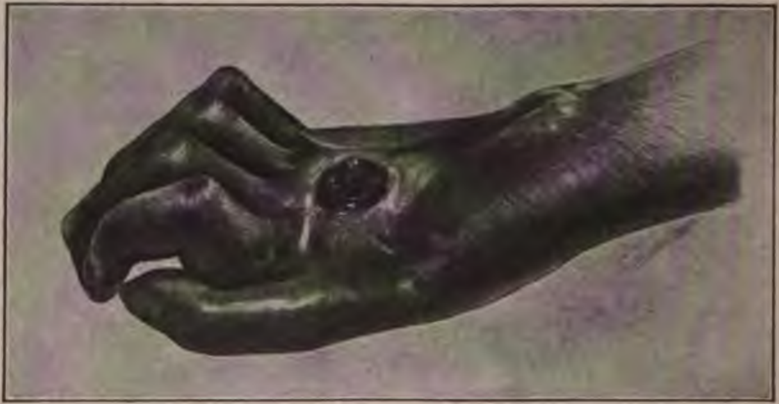

FIG. 207.—LOSS OF EXTENSOR TENDONS FROM SUPPURATION, AND CONTRACTION OF SCAR OF MANY YEARS PREVIOUS. The ulcer is recent.

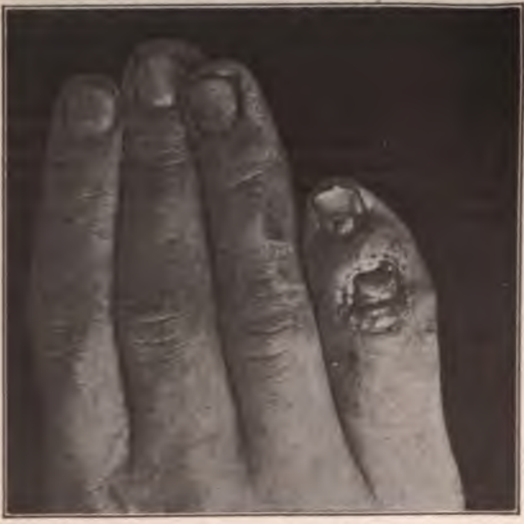

FIG. 208.—SUPPURATION IN JOINT FOLLOWING PENETRATION BY A SPLINTER SIX WEEKS PREVIOUSLY.

No matter how extensive the suppuration, the same principles of treatment are applicable, viz., free incision, drainage facilitated by a wet dressing or a constant bath, and absolute rest to the part. These principles faithfully observed will often fully restore the function, even though suppuration has extended into the forearm.

Suppurative Synovitis; Suppurative Arthritis.—Infection may reach a joint and set up suppuration in the synovial sac which lines it, or in the ends of the bones themselves. This accident is usually due to the direct entrance of some sharp instrument into the joint itself. For example, a man with clenched fist strikes another a blow in the mouth. The edge of one of the incisor teeth may easily break through the skin and the capsule of the metacarpophalangeal joint as they are tightly stretched over the head of the bone. The wound itself appears trivial, but in the course of a day or two the joint swells and becomes very painful, a little mucopurulent fluid finds its way out through the wound, and may be recognized by its tenacity if the finger which touches it is slowly drawn away. This is an absolute sign that fluid has come from the cavity of a joint or synovial sheath or a bursa; in other words, that it contains mucin. Pressure on the end of the injured finger, tending to crowd the bones together, causes pain.

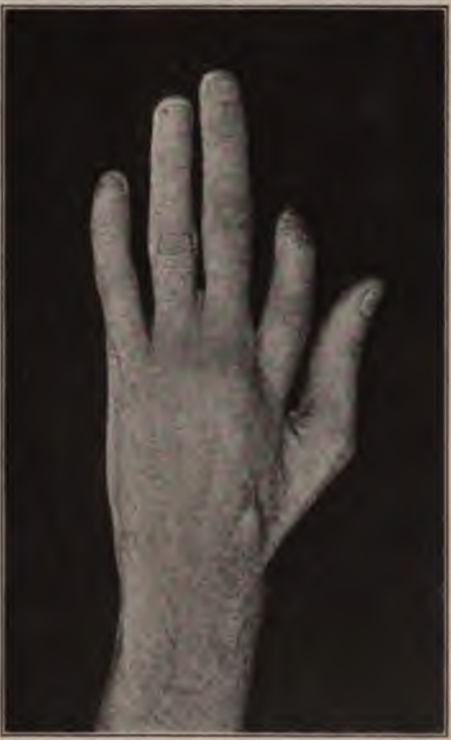
Fig. 209.—Suppurative Arthritis and Loss of Metacarpal Following Wound of Joint Made by Teeth One Year Previous.

The shape of the swollen finger also indicates that the inflammation is located in a joint; for its maximum transverse diameter coincides with the plane of the affected joint, the whole finger being fusiform (Fig. 208). Compare the shape of the fingers shown in Figure 191, page 402, and Figure 204, page 420.

Suppuration in a joint, if prolonged, leads to destruction of the cartilage, and later of a portion of one or both bones which make up the joint. If only one bone is destroyed, there may still be considerable motion in the joint, so great is the power of the body to maintain its functions under adverse circumstances. In

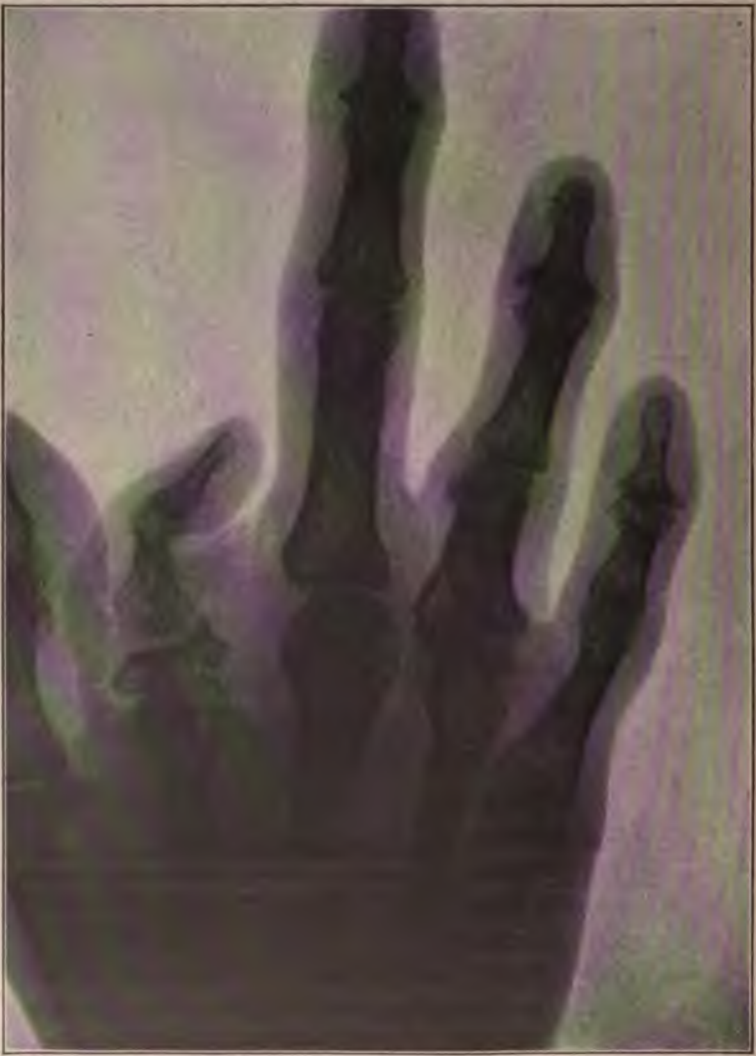

FIG. 210.—RADIOGRAPH OF A HAND IN WHICH THERE WAS EXTENSIVE LOSS OF BONE FOLLOWING SUPPURATIVE ARTHRITIS.

Figure 209 is shown an extreme case of this character, in which the whole metacarpal bone was lost from suppuration following a tooth-wound on the back of the metacarpophalangeal joint. The finger had a considerable range of motion. Figure 210 is a radiograph of a similar case in which a part of the metacarpal bone was preserved. In the usual case the destruction of cartilage produces a rough grating when the bones are slipped upon each other; but if free drainage is instituted at this stage the case goes on to recovery without loss of bone. Convalescence is slow, however, and the function of the joint may never be fully regained. If treatment is commenced before erosion of the cartilaginous ends of the bones, two or three weeks' treatment should result in complete healing of the wound, and restoration of function should ultimately be complete.

Treatment.—The treatment of suppurative synovitis consists in an incision into the joint, irrigation of the joint cavity with peroxid of hydrogen and water, one part to six or eight, a moist gauze dressing, with or without a drain which reaches through the capsule of the joint, and a splint to keep the bones absolutely at rest. If the wound is a posterior one, the incision should also be made posteriorly. If the wound is an anterior one, the joint may perhaps be drained more satisfactorily from the posterior side; or anterior and posterior drainage may be indicated. In a few days when the acute suppuration has subsided, the daily discharge will consist of a few drops of seromucopurulent fluid. If a drain has been kept in the joint cavity, it should now be removed. The gauze dressing should be light, not more than six or eight or twelve thicknesses, so that the splint may hold the finger firmly. A sheet of thin tin, cut from a cracker-box and molded accurately to the finger and hand, answers admirably for this purpose (Fig. 211). A pattern should first be cut out of paper. The base of the splint should reach nearly to the carpus, and should extend for an inch on either side of the metacarpal bone. The remainder of the splint should be broad enough to form a gutter half encircling the finger. The sharp edges of the splint should be slightly bent away from the hand to avoid pressure.

Sometimes, on account of pain, the finger cannot at once be extended. The splint should then be bent to fit the position of the finger, and at each daily dressing a little more extension can thus be obtained.

Treatment of this character to be successful must extend over several weeks. In the beginning the dressing should be changed every day, and later on three times a week. The ultimate result in many instances will be a movable joint, although one cannot promise such a favorable outcome. However, most patients prefer even a stiff joint to resection of a joint or amputation of the finger, which are the alternatives of choice.

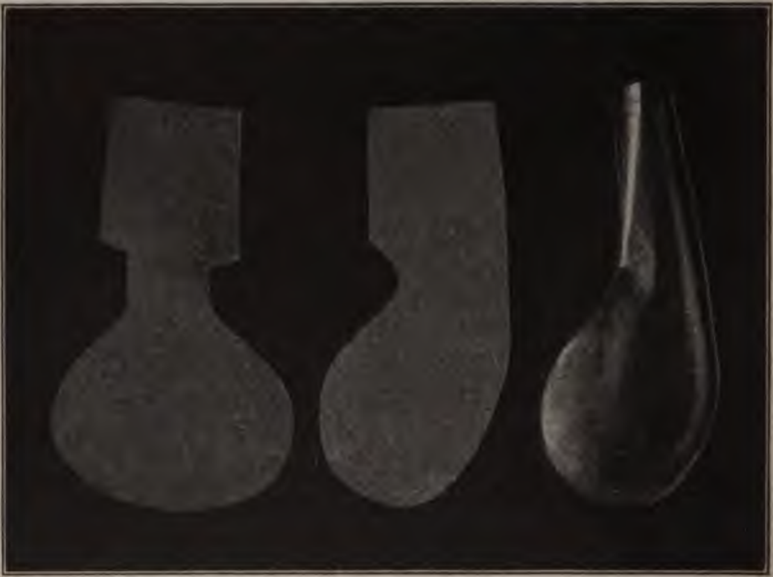

Fig. 211.—Tin Splint Cut from Cracker-box with Bandage Scissors, for Use in Case of Suppuration of the Metacarpophalangeal Joint of the Second Digit. At the left of the illustration are two paper patterns. The tin splint was cut from the pattern next to it. The other shows the shape of a splint for the third or fourth metacarpophalangeal joint.

When the sinus has quite healed, the patient should still wear his splint and keep the finger at rest for a couple of weeks, treating the finger with a daily bath and rub, but not attempting to bend it until the swelling and soreness have disappeared. Undue eagerness on the part of the surgeon or patient to prevent stiffness of the finger by early motion will probably result in a renewed secretion of mucopurulent fluid into the joint cavity, which will in turn require another incision and a new period of treatment.

If the ends of the bones are dead, so that they grate roughly upon one another, the casting off of the dead tissue may still safely be left to nature if free drainage is provided. This is a tedious process, and the financial condition of the patient may make necessary the resection of the ends of the bones or the amputation of the finger. The latter operation usually gives a shorter period of recovery.

The description of suppuration in one of the joints of the fingers and the treatment therewith outlined is applicable to suppuration in the larger joints of the wrist and arm; but the constitutional effects of these larger lesions are so great that the patient who suffers with them has passed from the field of "minor surgery."

Suppurative Olecranon Bursitis.—A rather common form of abscess in the arm starts in the olecranon bursa. The wound may be insignificant. The germs multiply rapidly in the bursa, as they do in all preformed serous cavities. If the bursa is intact, so that the seromucopurulent contents cannot escape, palpation will at once reveal a distinct rounded tense swelling. In most cases the fluid which accumulates in the bursa escapes through the wound,

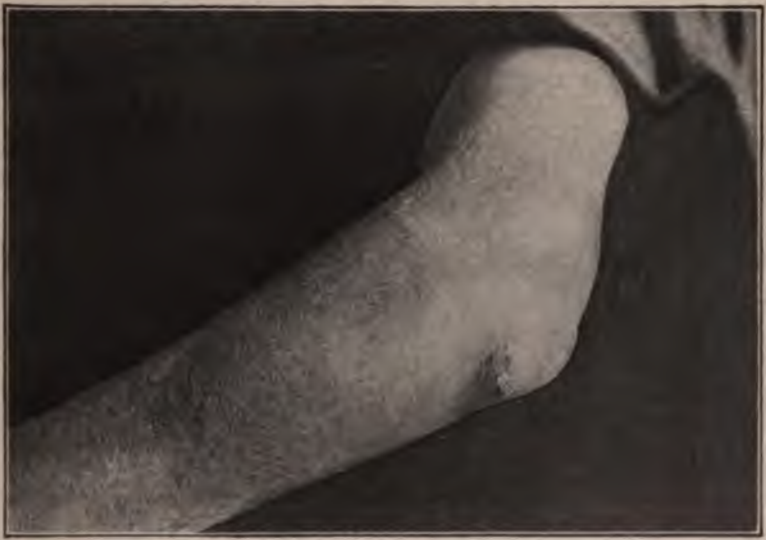

FIG. 212.—SUPPURATIVE OLECRANON BURSITIS. The characteristic swelling of the distended bursa is somewhat masked by the cellulitis around it.

and this prevents distention of the bursa, while the edema of the adjacent soft parts obscures its outline. This renders a diagnosis more difficult. Sometimes suppuration starting in the bursa breaks into the tissues outside its wall, and then the usual signs of a subcutaneous abscess are added (Fig. 212).

Treatment consists in exposure of the abscess cavity by a longitudinal incision. The bursa should be removed or allowed to granulate from the bottom, as otherwise relapse is likely to occur. If there is an extensive abscess, it is often of advantage to drain on both sides of the arm. Through and through drainage by means of gauze or rubber tubing may then be employed, but only for a few days. After that the drains should be inserted from both sides, but should not touch in the middle, so that repair of the deeper portion may be favored. It is easy to keep up a sinus by leaving a drain through a limb.

Lymphangitis.—It was stated on page 399 that inflammatory lesions may develop in related structures at a distance from the origin of an infection. These lesions are conveniently spoken of as "regional" in relation to the original lesion. They are lymphangitis and lymphadenitis. Either may lead to the formation of an abscess.

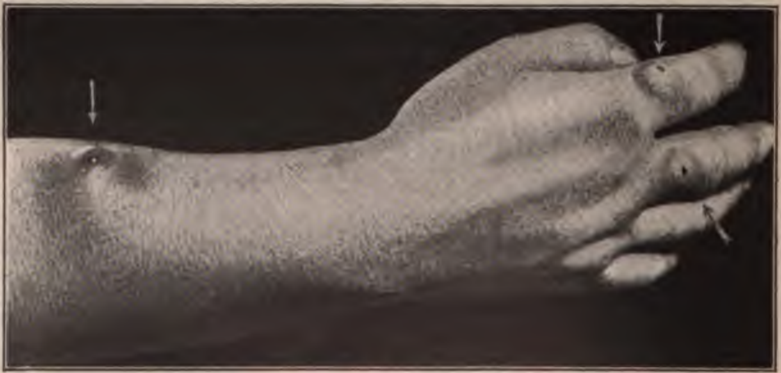

FIG. 213.—INFECTED WOUND OF FINGER WITH ABSCESS DEVELOPING IN THE COURSE OF THE LYMPHATIC VESSEL. The arrows are directed to these points.

Lymphangitis is produced by the extension of infection along the lymph vessels which drain the site of an infected wound. Usually the wound is insignificant; sometimes it is found with difficulty. The inflammation of the lymph vessels causes them to appear as slightly indurated red streaks. They are usually only slightly tender and painful. More than one vessel is involved in most cases.

Treatment consists in the cleansing, and drainage, if necessary, of the original wound. When this has been accomplished the lymphangitis quickly subsides, sometimes in a day or two. The portion of the arm which is inflamed is often enveloped in a wet dressing. This may be either cold or hot. The dressing makes the arm feel comfortable, and by maintaining an even temperature it probably facilitates recovery, but its curative action must be very slight.

Only rarely does an abscess form in the course of the inflamed lymphatics (Fig. 213).

Lymphadenitis.—The regional lymph glands are very frequently involved in connection with infected wounds of the fingers and hand. In many instances it is evident that the bacteria pass through the lymphatic vessels without visibly affecting them, and produce a reaction in the lymphatic glands. The glands at the elbow are not often involved; those in the axilla are usually the ones affected, whether the wound is on the front or the back of the hand. In many cases the glands are palpably enlarged and tender, but if the original wound is properly treated, suppuration in the glands does not take place; but even in favorable cases they do not so quickly resume their normal condition as do the lymphatic vessels. One or two weeks are often necessary before the tenderness and swelling disappear. In other cases the swelling of the glands continues or increases until abscesses are formed in them, which in the course of time may break through the capsules and form a single large abscess. Infection from the hand affects the deeper glands of the axilla, so that the latter may swell to a considerable extent before the skin shows any change.

If the infection starts in the hair-follicles of the axilla, and an abscess is formed in the subcutaneous fat or in the superficial glands, the parts present quite a different appearance (Fig. 214). This is a very common trouble, and one which is annoying rather than serious. The skin is invariably reddened, and shows one or more pustules, or perhaps also sinuses, if the abscess has already ruptured. The whole inflamed mass can be moved upon the deep axillary fascia. The process is correctly termed a *superficial axillary abscess.*

TREATMENT.—Local anesthesia is sufficient for the treatment of a superficial axillary abscess. The hair should be cropped with scissors, the skin washed and cocainized. The abscess should then be opened by a *transverse* incision near its lowest portion, an incision, in other words, parallel to the seam joining a sleeve to a coat. Fragments of glands should be curetted or cut away, and if more than one abscess cavity exists, they should all be made to drain freely into the wound. The edges of the wound should be kept apart by gauze for some days, until granulation is well established in the deeper parts of the wound.

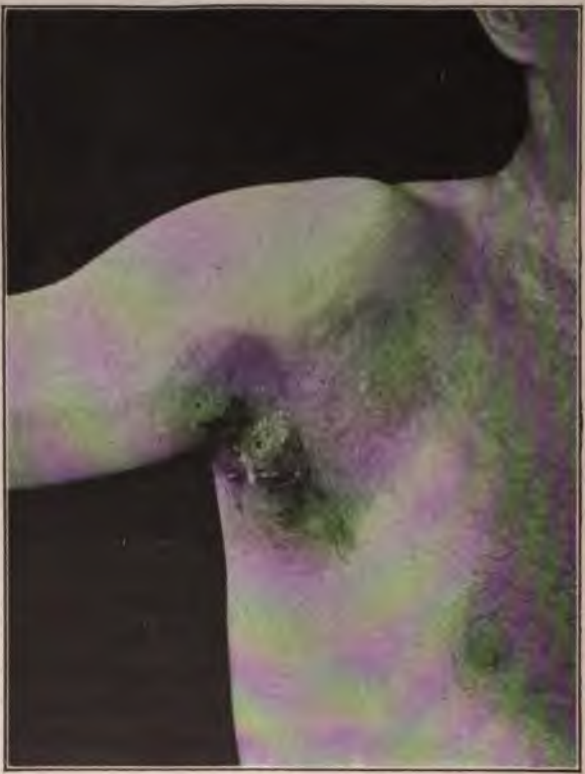

FIG. 214.—SUPERFICIAL AXILLARY ABSCESS FROM INFECTION ABOUT HAIRS; TWELVE DAYS. Pus is seen dropping from a spontaneous rupture. Patient a man aged thirty-nine years.

The treatment of suppurating deep glands of the axilla is a more serious undertaking, and is best carried out when a general anesthetic has been given. The skin of the axilla should be shaved and cleansed and a *longitudinal* incision made; an incision, in other words, parallel to the edge of the greater pectoral muscle. If the glands are freely movable in the surrounding areolar tissue their removal is easy; it may be very difficult if exudation has matted the various planes of tissue together. Under such circumstances the surgeon may think it best simply to open the various abscesses, drain them, and wait for the wounds to close by granulation. He usually has to wait some weeks, as the tissue of the gland is so spongelike that it affords a splendid opportunity for the continued propagation of bacteria, while the circulation in this spongy tissue is so good that the bacteria do not generally cause its necrosis after the pressure has been relieved by the incision of the gland capsule. Therefore, it is a good rule to remove a suppurating gland wherever this can be done easily. The next best thing to the complete removal of the gland is to scoop it out of its capsule piecemeal by means of a curette. If the glands are removed entire, temporary drainage with rubber tissue will suffice and the greater part of the incision may be sutured. If the glands are merely incised, or incised and curetted, or if the abscess at the time of operation has already extended beyond the capsule of the gland, gauze drainage through an unsutured incision should be maintained for some days until granulation takes place.

The treatment outlined for the deep suppurating glands is the same as that employed for tuberculosis of the axillary glands. In the latter case there is, of course, an additional reason for the complete removal of the glands in that the seeds of disease which they contain may spread to other glands or other organs.

Eczema.—The hand and forearm are favorite seats of eczema, which occurs in all its forms—erythematous, papular, vesicular, and pustular. When of a chronic character, scales and crusts and fissures are well shown, particularly upon the palm. Besides whatever form of "debility" may be the predisposing cause of the eczema, if the lesions are located upon the hand or arm, there is almost always a well marked local cause such as exposure to heat or cold, contact with strong chemicals, including laundry soaps and washing powders, irritating sand, etc. The history will generally indicate the diagnosis, which will be confirmed by the presence of the four cardinal symptoms—erythema, serous exudation, infiltration of the underlying skin, and itching. Eczema must be differentiated from the following diseases:

Urticaria occurs in wheals scattered indiscriminately over various surfaces of the body.

Erysipelas gives a continuous blush, which spreads constantly from the edge. This and its constitutional symptoms sufficiently distinguish it from eczema.

Dermatitis from poison ivy closely resembles acute eczema. Its distinguishing characteristics are a history of exposure to the plant, the acute spread of the lesions, and their transference from one part of the body to another by contact, as from the hands to the face, neck, or genitals.

TREATMENT.—Applications useful in the treatment of eczema have been mentioned on page 58. If the best results are to be obtained, the irritating causes must, of course, be done away with.

Sometimes a syphilitic eczema of the finger, especially of the forefinger or thumb, will persist long after all other signs of the disease have disappeared. The constitutional treatment should be continued under such circumstances, even though the patient may have taken medicine regularly for the usual period of two years or more. In addition, local applications, such as mercurial ointment, Lassar's paste, or strong preparations of salicylic acid should be applied during the night, in order to cause the old skin to scale off and give place to a newer, healthier growth.

Ulcer from Vaccination.—In normal vaccination the pustules dry up and the resulting scab remains in place until the repair of the skin is complete. If germs of various sorts are allowed to enter the lesion, at the time of vaccination, or afterward by a premature removal of the scab, the inflammation and loss of tissue may be extreme. It is no unusual thing to find an ulcer on the arm or leg of a child an inch in diameter and one-third of an inch deep. Such an ulcer is usually very slow in healing, and should be stimulated with nitrate of silver. The ulcer may be painted with a ten per cent solution of nitrate of silver, or gauze wet with a four per cent solution may be kept over the ulcer. This dressing should be moistened four times a day with water and changed every day until granulation is well established. (Compare the treatment of ulcers of the leg, Chapter XVIII.)

Articular Rheumatism.—The less acute inflammations of the upper extremity are for the most part located in the joints. A complete study of joint affections is manifestly impossible in a work of this character, but it is worth while to consider the surgical aspects of articular rheumatism, gonorrheal arthritis, arthritis deformans, gout, syphilis, and tuberculosis.

The onset of articular rheumatism is sudden, with fever and its accompanying symptoms. One or more joints are diffusely swollen, and very tender and painful. Different joints may be involved at the same time, or one after the other. The affected joint contains little fluid. The administration of salicylates internally seems in some cases to hasten the restoration to normal of the affected joints. In other cases it seems to have no effect in this way. Pain, redness, and extreme tenderness usually disappear in a few days. Some swelling, and limitation of motion by tenderness and adhesions, persist for a longer time, possibly for weeks.

Local Treatment.—Twenty or thirty drops of guaiacol should be sprinkled on a layer of cotton. This is wrapped around the joint, covered with oiled silk, and bandaged in place. The joint should be immobilized by a splint or sling. The initial pain is much relieved in this manner. In a few days hot fomentations or baking are indicated. When pain has disappeared and the swelling is diminishing, massage and active and passive motion of the joint is advisable. At a still later period it is sometimes desirable to give an anesthetic in order to break up adhesions. This should never be done until all signs of acute inflammation have passed.

During the painful stage of rheumatism of the wrist or fingers, the hand and fingers should be constantly extended. This position is favorable to subsequent treatment of any adhesions which form, for it is much easier to gradually flex a stiff, extended joint than to extend one which is adherent in the position of flexion. Therefore, if these joints are flexed or partly flexed, when the patient is seen for the first time, a splint should be applied, to prevent increase of flexion, and each day a slight extension of the part should be made and the splint reapplied in the better position.

Gonorrheal Arthritis.—In about ten per cent of the cases of gonorrhea some joint is involved. This occurs in the third or fourth week of the disease, or still later. This lesion is often spoken of as a monarticular one, and so it frequently is; but the fact should not be lost sight of that in more than half of the cases of gonorrheal arthritis, more than one joint is involved. However, the inflammation does not skip from joint to joint, as in rheumatism, but pursues a tedious course of four weeks or more in each joint that is affected. Other distinguishing marks are the effusion into the joint cavity, edema of the soft parts, involvement of any bursæ or tendon sheaths in the immediate vicinity of the joint, and the moderate character of the pain and tenderness.

The treatment is similar to that for articular rheumatism: rest on a splint, with hot or cold applications to relieve pain during the first stage; then baking, followed by massage, and passive and active motions. Restoration of function is usually complete.

Deforming Arthritis.—This disease is also known by the names osteitis deformans, rheumatoid arthritis, and others. It is characterized by slight swelling, pain, and tenderness of the various joints of the body, and alterations of the articular ends of the bones due to deposits of lime salts. The range of motion in the joints is thereby greatly interfered with, and various deformities are produced, such as flexion, overextension, or lateral displacements.

When advanced, this disease is unmistakable; in its beginning it may be mistaken for articular rheumatism or gout. It has not the fever nor pain of the former, nor the chalky skin deposits, and usually not the nephritic symptoms of the latter.

Local treatment consists in maintaining and, if possible, increasing the range of motion of the joints during the periods of quiescence of the disease. The affected limbs should be baked to 300° F., if the patient can stand it, and then vigorously massaged either manually or, still better, by mechanical vibration. Active motion should be encouraged for the sake of both joints and muscles. The use of splints is contraindicated, since immobilization in these cases reduces still further the range of motion. Sometimes increased motion may be obtained by manipulation under an anesthetic, but such increased freedom is not generally permanent. In this, as in most joint adhesions, a slight, gentle motion, many times repeated, has a far greater permanent good effect in increasing the range of motion of the joint than an occasional violent motion.

Gout.—While early attacks of gout are often confined to the metatarsophalangeal joint of the great toe, they are common enough in some of the smaller joints of the upper extremity. The family history, and symptoms of gout manifested by the heart, kidneys, and gastrointestinal tract will usually indicate the true diagnosis. The affected joint (or joints) is swollen, hot, red, painful, and tender, similar to the joint affected by articular rheumatism. Other joints should be examined for evidences of previous attacks, and uratic deposits looked for in the skin of the hands, feet, and ears.

The extreme tenderness and pain usually last only a day or two. During this time pain may be lessened by guaiacol applied on cotton and covered with oiled silk, or ice cloths may be applied, or the patient may find very hot applications more comforting. The best and simplest way to apply moist heat is to wrap the joint with hot moist compresses, cover these with oiled silk, and then to increase and keep up the heat by laying hot bottles or bags on either side of the limb. These can be changed from time to time. In this way the temperature can readily be kept as high as the patient can bear it, and the inner dressing need not be touched. If it dries, the protective should be opened, and hot water poured upon the compresses. Various counter-irritants are also employed. Tincture of iodine is the cleanest, and perhaps as good as any. When the attack has passed over, massage is beneficial, as these patients usually take too little exercise.

If the gouty deposit of urates is large, or is so situated that it will interfere with the use of the member, or if it is very painful, it should be removed. This can easily be done under a local anesthetic. The wound heals as promptly as any clean wound. An isolated nodule in an unusual situation has been mistaken for a tumor.

Syphilis.—Lesions of syphilis at every stage are found in the hand and arm. The primary sore or chancre has several times developed upon the forefinger of a physician after examination of a syphilitic patient. A chancre may also develop after contact of the hand with the teeth of a syphilitic patient. Such a case is illustrated in Figure 215.

Late lesions of syphilis are often found in the upper extremity. Eczema of the fingers is mentioned on page 431. Gumma of the skin forming an ulcer (Figs. 216 and 217) has the usual characteristics of gumma in other parts of the body, and demands the usual treatment. (See p. 61.)

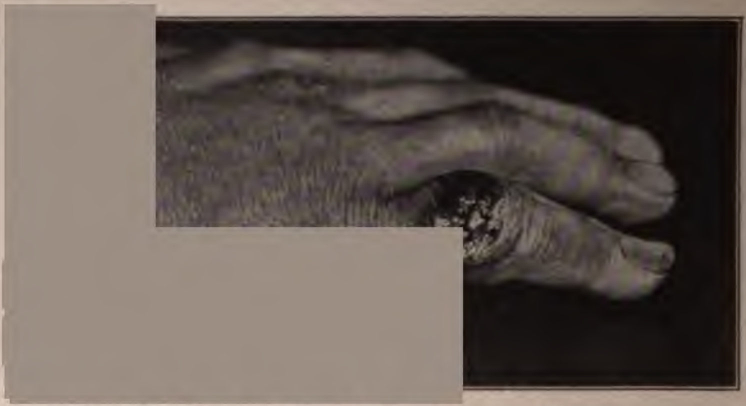

FIG. 215.—PRIMARY LESION OF SYPHILIS DEVELOPING IN A WOUND OF THE FINGER MADE BY HUMAN TEETH. Photograph eleven weeks after injury.

Syphilitic Dactylitis.—When the soft tissues of the joints of the fingers become gummatous, or a gumma forms in one of the phalanges, the condition is called syphilitic dactylitis. The affected portion of the finger is spindle-shaped or spherical, the skin

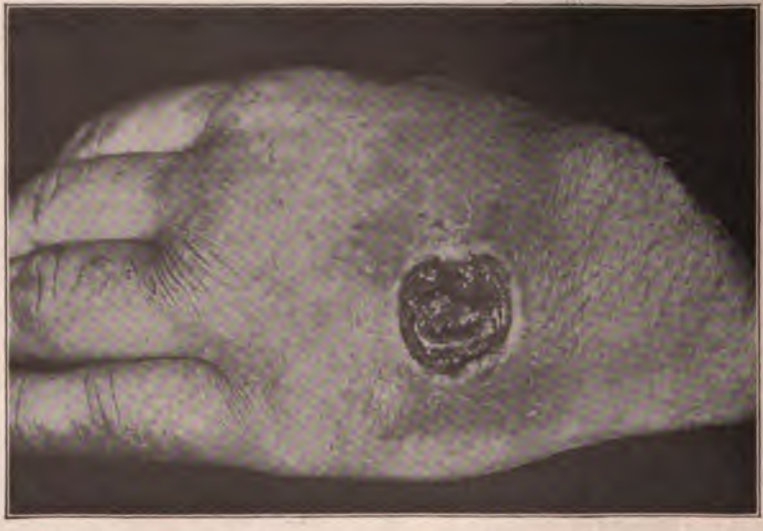

FIG. 216.—SYPHILITIC ULCER OF THE HAND, OF FOUR MONTHS' DURATION. Patient a male aged thirty-seven years.

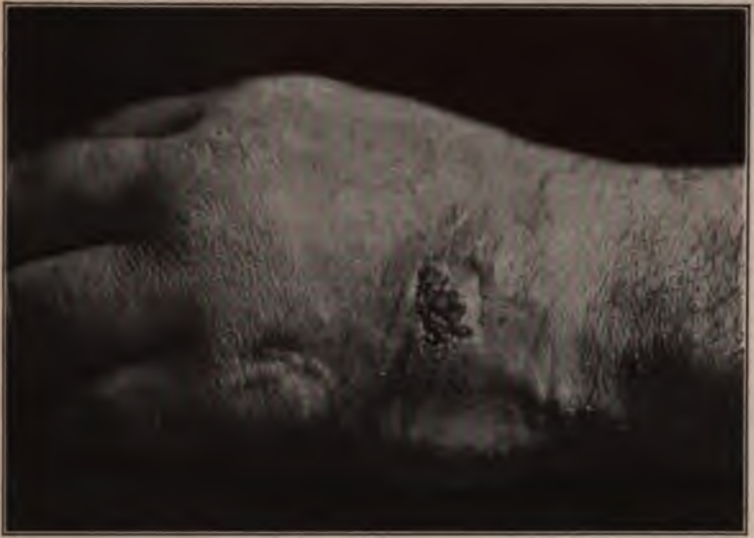

FIG. 217.—THE SAME HAND AS SHOWN IN FIG. 216, AFTER FOUR WEEKS OF TREATMENT BY IODID AND MERCURY.

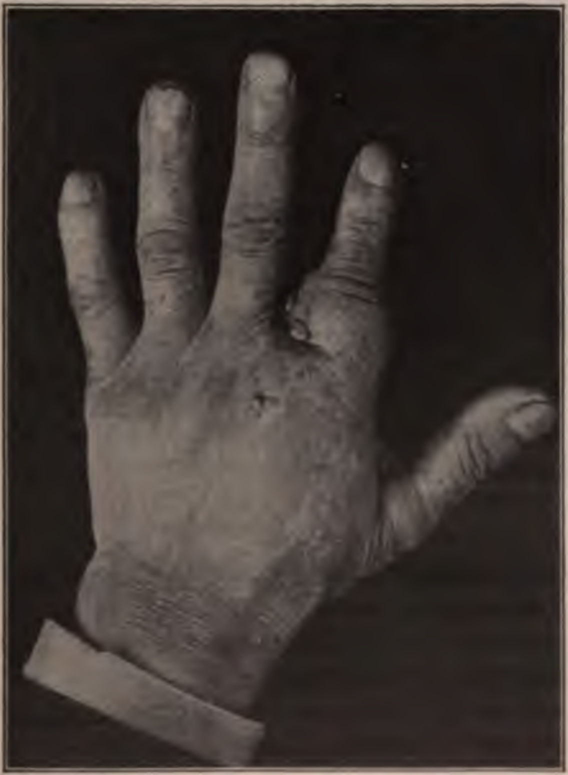

FIG. 218.—CHRONIC INFLAMMATION OF HAND WITH SINUSES OF TWO YEARS' DURATION; PROBABLY SYPHILITIC. Patient a man aged fifty-five year

is dusky red and shiny, the underlying tissues are firm or, later, boggy, and flexion of the joint is interfered with by the swelling, although abnormal lateral motion is possible. The amount of pain varies in different cases, and may be wholly wanting. After some weeks or months the skin may break and allow the discharge of characteristic syrupy fluid. The discharge afterward becomes purulent (Fig. 218). The formation of sinuses may not take place for months, or recovery may occur without any sinuses being formed. In other cases there is necrosis of bone which keeps open the sinuses.

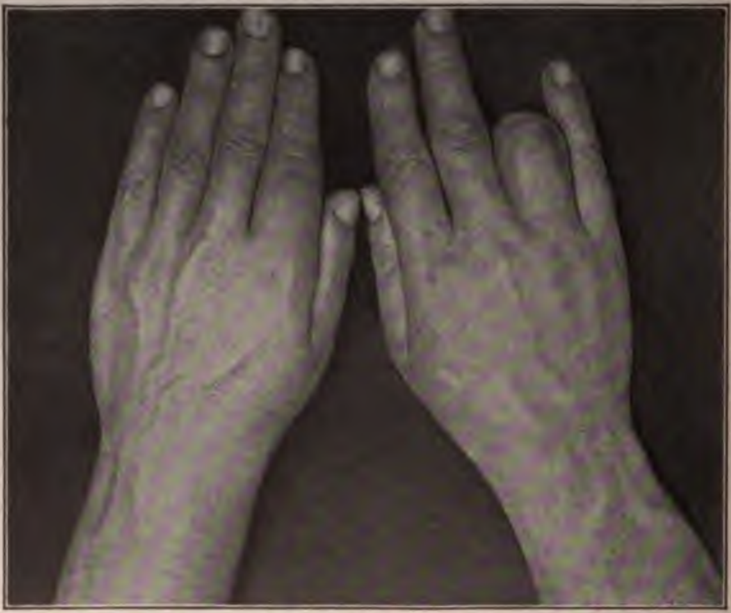

FIG. 219.—SYPHILIS OF LEFT WRIST, LEFT FOREFINGER, AND RIGHT RING-FINGER, COMMENCING ONE YEAR AGO IN THE RING-FINGER, A PART OF WHICH WAS AMPUTATED BY A PHYSICIAN. Patient a woman aged thirty-six years.

Differential diagnosis with tuberculous dactylitis, sarcoma, and chronic purulent synovitis may be extremely difficult. An exact history of the case, a radiograph, two weeks' treatment with iodid of potash, with a splint and wet dressings to the finger if the joint has been opened, will almost always dispel the doubt. Amputation should never be resorted to in syphilitic cases, as recovery is almost always perfect if internal treatment is persisted in. Moreover, amputation is no preventive of recurrence (Fig. 219), even in the stump of the amputated finger.

Tuberculosis of Tendon Sheaths.—There is also a chronic inflammation of the tendon sheaths, due to the tubercle bacillus, at least in most cases. Either the flexor or extensor tendons may be involved (Figs. 220 and 221). The sheaths of the tendons are gradually distended with fluid which is at first serous, but which later contains rice bodies. These are fibrinous bodies about as large and about as slippery as wet melon seeds. They can often be detected by palpation, and can often be made to slip back and forth under the annular ligament from one relaxed portion of the sheath to the other. The condition may remain about the same for months, causing little or no pain, and no swelling of the tissues outside of the sheaths; or the tubercular process may be more active, giving pain and edema, with a discharge of pus and detritus into the cavity of the sheath, or through the skin.

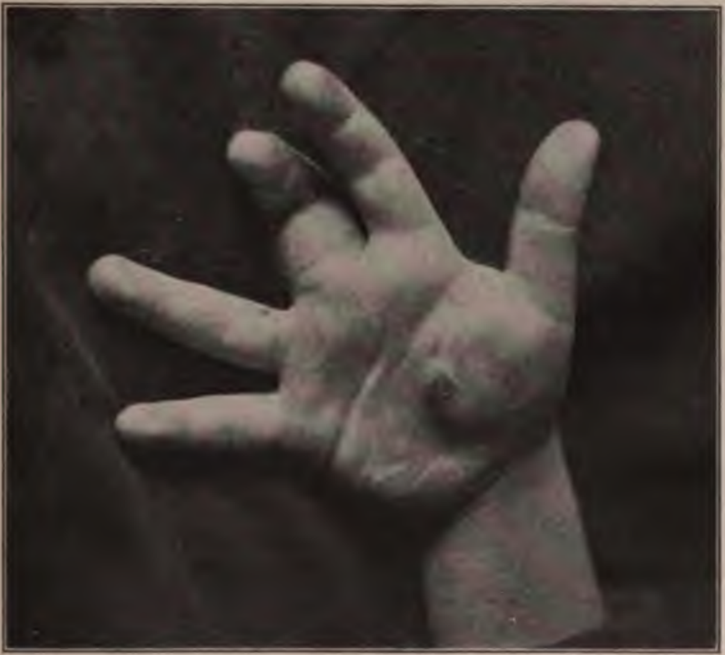

FIG. 220.—TUBERCULOSIS OF FLEXOR TENDON SHEATHS OF HAND. Especial distention of sheath of middle finger; sinus in palm. Patient a boy aged six years.

TREATMENT.—The only treatment to be advised is the complete removal of the affected tendon-sheaths by dissection under a general anesthetic. If this operation is performed at an early stage, the wounds may be sutured, and will usually unite primarily. Slight active motions should be begun in a week to prevent permanent adhesions. There is in many cases full restoration of function. Operations performed in the suppurative stage, or after the disease has extended beyond the synovial membrane, do not have so favorable a result.

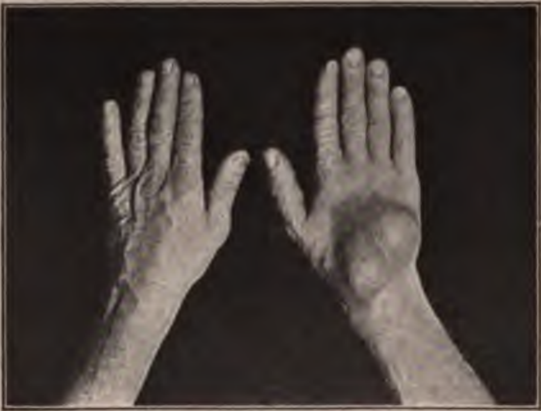

FIG. 221.—TENOSYNOVITIS, PROBABLY TUBERCULAR, OF FIVE MONTHS' DURATION. Patient a man aged forty-nine years.

Tuberculosis of Joints.—In tuberculous arthritis of the upper extremity the disease may begin in the synovial membrane, or, more commonly, in the extremity of one of the bones forming the joint. In the latter case it usually extends into the joint, but not necessarily so, as it may extend in the other direction, and when suppuration takes place the pus may break through the skin without having entered the joint. In the usual case, however, the joint is early involved, and the tuberculous arthritis which then exists must be differentiated from the various other chronic inflammations of a joint.

SYMPTOMS.—The early symptoms of tuberculous arthritis are local heat, swelling, limitation of motion, partial loss of function, usually pain and tenderness, and muscular atrophy. This last is a symptom which occurs early in the disease, and is almost always demonstrable when the doctor first sees the patient. Muscular spasm, which is so prominent a symptom in tuberculosis of the joints of the lower extremity, is not so easily produced in the joints of the upper extremity. These various symptoms are worth further attention.

Local heat is readily determined by comparing the affected joint with other parts of the same limb, and with the corresponding joint of the opposite limb.

Swelling should be measured circumferentially in inches or centimeters, not guessed at. It is a good plan to measure at the same time the circumferences of both limbs a certain distance above and below the plane of the affected joint, to determine the presence of *atrophy*.

Limitation of motion, both active and passive, is ascertained by testing the various normal motions of the joint, one after the other, to the fullest possible extent. A goniometer is an instrument to measure the range of motion, but this can be estimated with sufficient accuracy by the eye, if one bears in mind that two bones at right angles to each other make an angle of 90 degrees; in the same line they make an angle of 180 degrees; while midway between a right angle and a straight line they make an angle of 135 degrees. If the quadrant in question is divided into thirds, the angles will be 120 degrees and 150 degrees (Fig. 222).

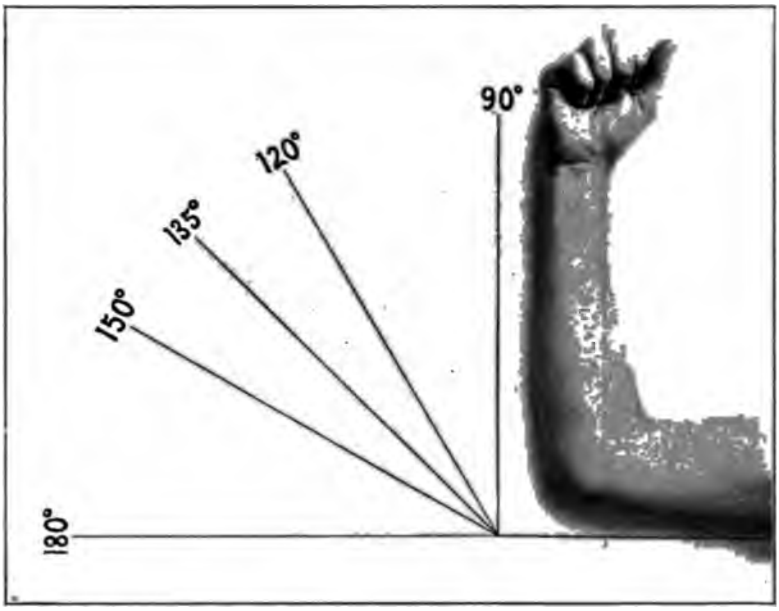

FIG. 222.—DIAGRAM TO AID THE EYE IN ESTIMATING THE RANGE OF MOTION IN A JOINT.

Loss of function may be due to limitation of motion or to loss of muscular power, or to the pain which use of the joint elicits. It should be noted in the history in exact terms for future comparison.

Pain and *tenderness* vary much in different patients. Presumably they are greater when there is an unruptured focus of disease in a bone than when such a focus has ruptured or when the disease is exclusively in the synovia or other soft tissues.

A *radiograph* shows the tuberculous bone to be distended and decalcified.

At a later stage there is often *fluctuation*, due to fluid within or outside of the joint; and there may be *abscesses* or *sinuses*. Discharge of pus through a sinus, of course, reduces the swelling. The sinus often becomes blocked and the swelling and other acute symptoms reappear until relief is again obtained by discharge through the same or another sinus (Fig. 223). If a probe will follow such a sinus it will either enter the joint or touch diseased bone.

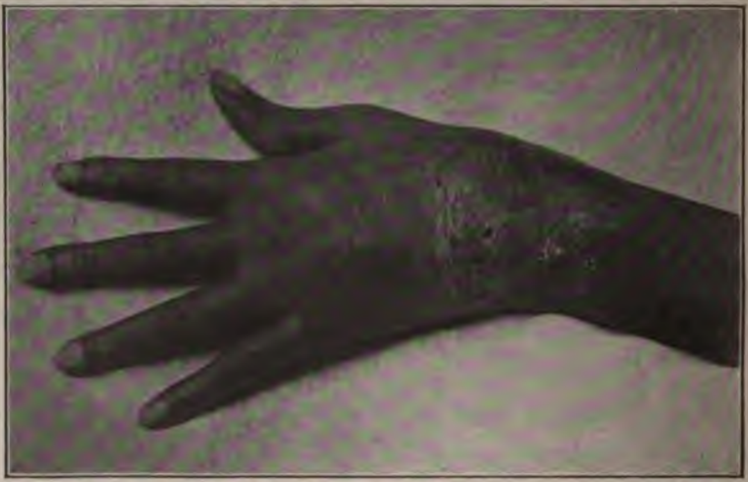

FIG. 223.—TUBERCULOSIS OF THE WRIST, ONE YEAR, WITH SINUS. Patient a man aged twenty-nine years.

Tuberculosis of the upper extremity is rare in both childhood and in adult life. The statistics of different observers vary, but it is probably safe to say that of all cases of tuberculosis of joints of the extremities, not more than two per cent fall to the shoulder-joint, two or three per cent to the elbow-joint, and less than one per cent to the wrist-joint and bones of the hand, giving a total of about five per cent for all the joints of the upper extremity.

Tuberculosis in the hand itself, or of the fingers, may be situated in the joints, or it may involve the shaft of one of the longer bones. In the latter case a fusiform swelling is given to the affected part, the center of the swelling being midway between the joints; whereas, in arthritis of whatever nature, the center of the swelling is opposite the plane of the joint. In syphilis there may be either type of swelling.

TREATMENT.—The first treatment of tuberculous arthritis is to keep the joint at rest by splints or plaster of Paris bandage. If fluid accumulates and causes pain or distends the skin, it should be evacuated through a small incision.

Injections of iodoform (ten per cent in glycerin) and other substances into the tissues around the diseased foci have been favorably spoken of by some surgeons, but their use is often disappointing.

If necrosis of a bone develops, the necrotic portion must, of course, be removed. Suitable splints should be worn until recovery is complete to limit the amount of the deformity as far as possible.

The tendency of tuberculosis of a joint in infancy and childhood is often toward recovery. Such a favorable outcome may be hoped for in adults, but it is far less frequent. If a reasonable time has been given to simpler measures and the condition of the patient does not improve, resection or amputation must be considered not only to terminate the local process, but to save the patient from extension of the disease to some other part of the body. These are operations fully discussed in books upon major surgery. The results of resection are often not much worse than those which follow a spontaneous cure, since more or less disability often remains. Hence, in an adult one should not put off too long the question of operation. It is hardly necessary to add that whatever the local treatment, constitutional hygienic and dietetic treatment is even more important. Out-of-door life will cure nearly all cases of joint tuberculosis in children.

Osteomyelitis.—Inflammation of bone, without or with necrosis, may follow suppuration in the wound of a compound fracture (p. 386), or in a joint which has been wounded (p. 423).

There is also a suppurative inflammation of bone, situated usually in the shaft or epiphysis, coming on without such evident traumatic origin, and known as osteomyelitis. In a well marked case there is a high fever, a chill, and intense pain in the bone, followed by convulsions or delirium, for the disease is generally in childhood or adolescence. There are also milder cases, with less pain and slight fever. Pain is invariably increased when the affected bone is jarred. After the pus distends or breaks through the periosteum, there are the usual signs of abscess in the soft parts.

Osteomyelitis is about five times more common in the lower extremity than in the upper. Its early recognition is of the greatest importance. Free exit should be given to the pus by an incision through the periosteum, and if the pus is not then reached the bone should be opened with drill or chisel. Such prompt treatment will often save the life of the patient, and may even permit recovery without necrosis of the bone, though this is rare.

CHAPTER XVI

TUMORS AND DEFORMITIES OF THE ARM AND HAND

TUMORS

Ganglion.—There is a cystic tumor often found in the upper extremity, and especially about the wrist, which is called a ganglion. It consists of a fibrous capsule, intimately connected with the capsule of a joint, or with a tendon sheath, and a synovial lining, and it is filled with a thin, clear, sirupy fluid. Its cavity may or may not be continuous with the cavity of the joint or tendon sheath. The origin of a ganglion is a matter of dispute. Some observers believe that it is a true hernia of the joint capsule, and others assert that it is a fibrous tumor, growing from the fibrous capsule of the joint or tendon sheath, the center of which undergoes degeneration, and contains fluid; and that this degeneration may extend until the cavity of the joint is opened.

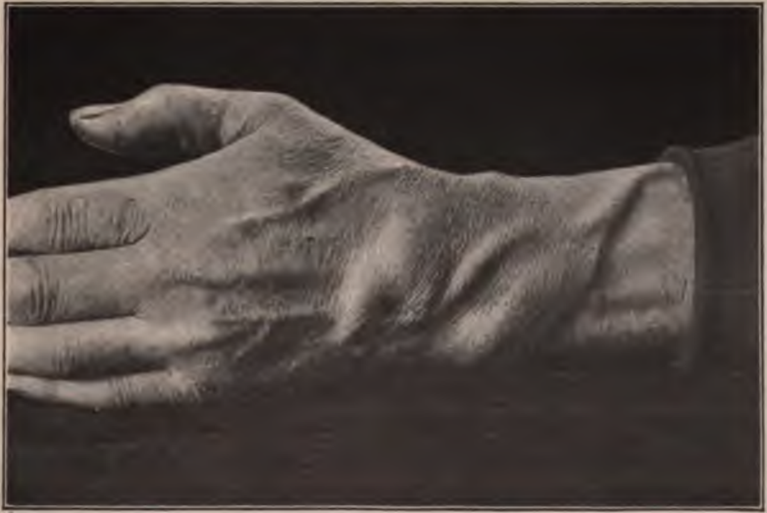

FIG. 224.—GANGLION OF WRIST. Patient a man aged fifty-nine years.

The most common situation for a ganglion is the back of the wrist, in the space between the tendon of the long extensor of the thumb and the long extensor of the index-finger, where it is intimately connected with the capsule of the joint. It frequently follows some overexertion, and the patient will say that he felt something give in the wrist-joint. A few days later a little puffiness will appear, which will increase in size and hardness as time goes on. Such a tumor may remain for months without much alteration, or it may gradually increase in size while tending to weaken the joint and to make its use painful. There is usually very little pain in the tumor when the hand is kept at rest. The overlying skin is freely movable and is not altered in appearance (Fig. 224).

If left to itself a ganglion tends to increase slowly in size until it is an inch or more in diameter.

Treatment.—The old treatment for a ganglion was to make it tense by flexing the hand, and then to rupture it by a sharp blow with a heavy book. If the blow succeeds in breaking the sac the fluid contents escape into the surrounding tissue. Pressure made by means of a coin and a strap of adhesive plaster for a couple of weeks may cause the sac walls to grow together and so to obliterate the cavity. Usually the cavity refills and the patient is as bad off as ever. It often happens also that the wall of the sac is so firm that it will not rupture, or that the amount of fluid contained in the tumor is so slight that its size is not much diminished by its removal. A more rational treatment consists in the complete removal of the tumor through a longitudinal incision, the connection with the joint being closed, if it exists, by a ligature or a suture. This operation may be performed with a

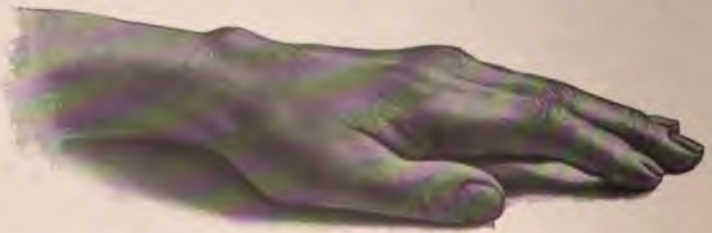

Fig. 225.—Ganglion of the Wrist. Lateral view to show the elevation of the tumor.

local anesthetic, as the tissues are readily anesthetized. A longitudinal incision is then made in the skin, about half an inch longer than the diameter of the tumor (Fig. 225). The tissues are carefully divided until the fibrous capsule of the ganglion is reached. The top and sides of the ganglion are then fully exposed by blunt dissection (Fig. 226). If the ganglion is a small one, and has a slender pedicle, this blunt dissection may be continued all around and beneath it until it is lifted from its bed, and the pedicle is ready for the ligature. In most cases, however, time is saved, and the dissection is rendered easier and less painful by opening the ganglion and evacuating its contents as soon as the sides of the capsule have been dissected free. It should then be split throughout its length so that the surgeon may obtain a clear view of its base and attachments. Nothing is to be gained, and needless injury may be inflicted by the attempt to remove it before it is opened, for the dissection of the base is the most difficult part of the operation, and the only part which it is hard to make absolutely painless. The whole of the sac should be dissected away, and its attachment ligated and divided (Fig. 227). If the sac is closely attached to bone, ligaments, or tendons, the outer portion of the sac may be left as long as its lining is removed. A ganglion sometimes recurs after a careful excision.

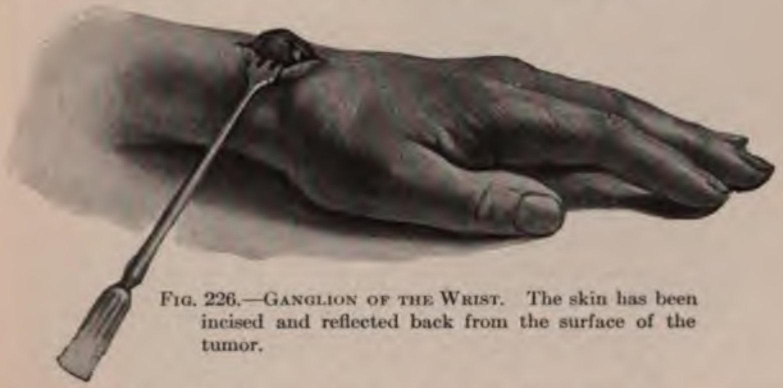

FIG. 226.—GANGLION OF THE WRIST. The skin has been incised and reflected back from the surface of the tumor.

Another method of treatment which often yields a prompt and painless cure is the injection into the sac of the ganglion of twenty or thirty minims of a mixture of equal parts of crystals of chloral hydrate and carbolic acid. These two crystals when mixed immediately form a fluid sufficiently thin for injection through an ordinary hypodermic needle. Before making the injection it is desirable to withdraw the greater part of the contents of the ganglion. Sometimes the contents are fluid; more often they are like jelly. Hence the aspiration should be made with a needle of large caliber, and the suction must be supplemented by strong pressure upon the sac. The injection of the carbolic mixture causes little if any pain. There may be some edema for a couple of days, but soon the sac shrinks, and may entirely disappear after a single injection. Unfortunately, the cure thus easily obtained is not always permanent.

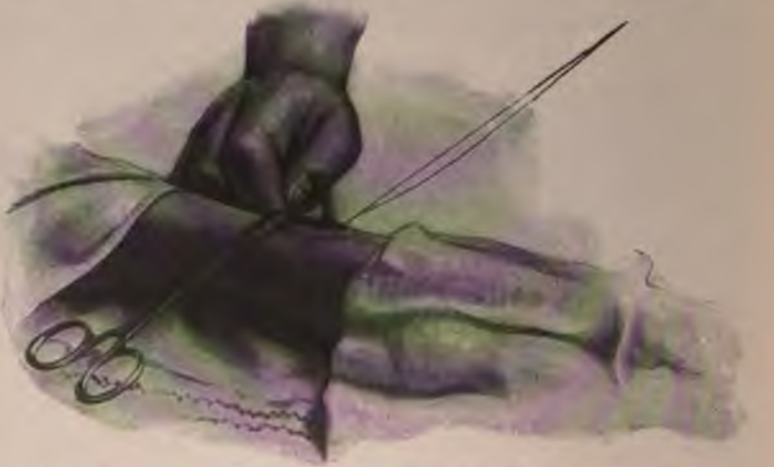

FIG. 227.—GANGLION OF WRIST, SHOWING THE LIGATION OF THE SAC.

Another method of treatment is the insertion of a needle by means of which numerous punctures are made through the sac, and its lining is scratched, and indeed the sac itself is torn to pieces as far as possible. This procedure should be followed by continuous pressure for several days to obliterate the space in which the fluid was contained.

Aneurism.—An arterial aneurism, the result of a punctured wound, is sometimes seen in the hand or wrist. When an aneurism due wholly to internal causes develops in the upper extremity, it is likely to be found in the brachial artery.

These tumors are small, smooth, elastic, compressible, and pulsating. They can be mistaken for some tumor overlying a normal vessel. Thus a ganglion of the wrist may lie on the radial artery and transmit the pulsation from the vessel, just as a cold abscess may transmit pulsation from an underlying artery. A careful examination will differentiate this transmitted pulsation from a true expansile pulsation.

The best treatment for aneurism of the upper extremity is dissection and ligation of the vessel involved both above and below the aneurism with chromic catgut. The blood-supply is so free that gangrene need not be feared. The wound should be completely sutured.

Varix.—One or more veins may be dilated, forming either a single smooth swelling (Fig. 228) or a more or less dilated and tortuous one (Fig. 229). Such a dilation is called a venous aneurism or a varix. If such a tumor connects with an artery, it may pulsate faintly. A characteristic sign is its almost com-

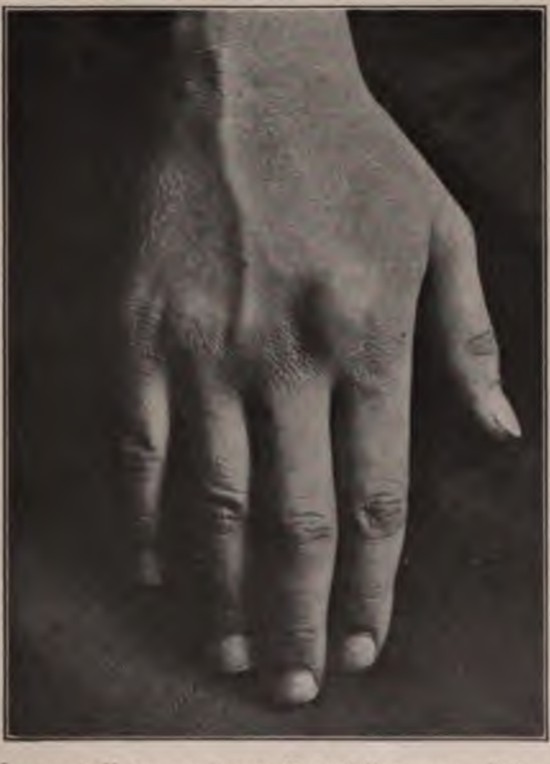

FIG. 228.—NEVUS OF HAND, OF SEVEN YEARS' DURATION. Patient a girl aged ten years. The tumor disappeared completely when the hand was held up.

plete disappearance on steady compression, combined with elevation of the arm, and its reappearance as soon as the pressure is removed. It is also softly fluctuating and gives a bluish shade to the overlying skin.

The treatment is the double ligation of the vessels with or without removal of the dilated portion. If a removal of the vessels is decided upon, it is well to place an Esmarch bandage around the arm before operation, and to ligate all visible cut vessels before removing the bandage, as bleeding from these dilated veins is very free. If an Esmarch bandage is not employed, the dissection and ligation should be carried on from below upward in order to avoid cutting and ligating the same vessel several times.

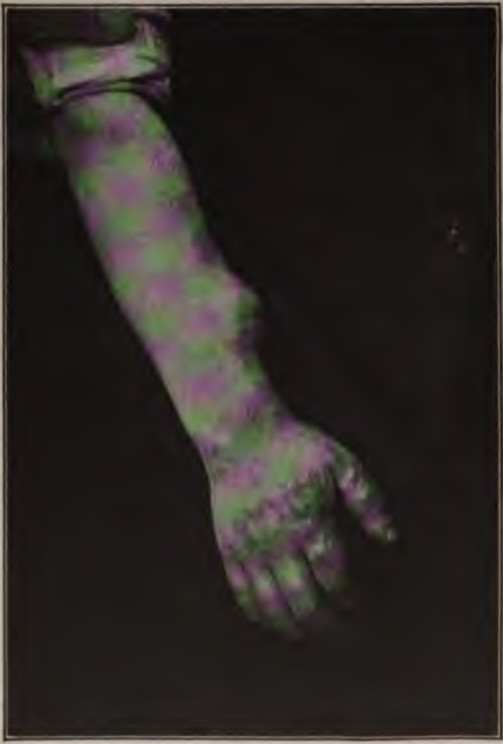

FIG. 229.—EXTENSIVE TORTUOUS VARICES OF HAND AND ARM.

Inclusion Cyst.—Sebaceous cysts do not occur in the hand, but similar cysts, lined with epithelium, are found in the skin of the palm. They are thought to be due to inclusion of epithelial cells, either during the embryonic period or postnatally, as a result of traumatism (Fig. 230). A cyst of this character is smooth, tense, possibly fluctuating, and intimately attached to the skin, which cannot be moved over it. It most nearly resembles a fibroma in physical characteristics. It should be removed entirely. This can usually be performed in such a manner that the wound can be closed by sutures. If not, the resulting small granulating wound will soon become covered by growth of epithelium from its edges.

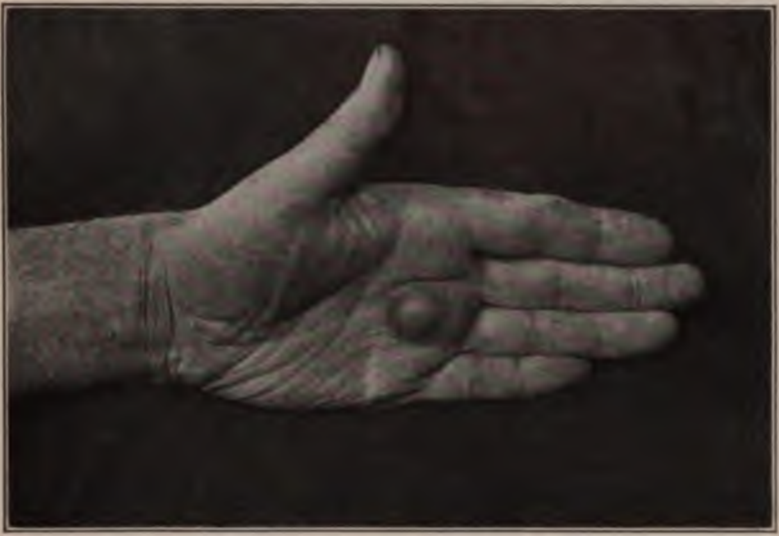

FIG. 230.—INCLUSION CYST OF PALM.

Lipoma.—This is a common tumor in the upper extremity, where it occurs both singly and in groups. A simple lipoma (Fig. 231), having the characteristics already described on page 137, when it occurs in the arm, can hardly be mistaken for anything else; in the hand it may be confused with fibroma, or one of the other tumors mentioned below. The technique of its removal is given on page 137.

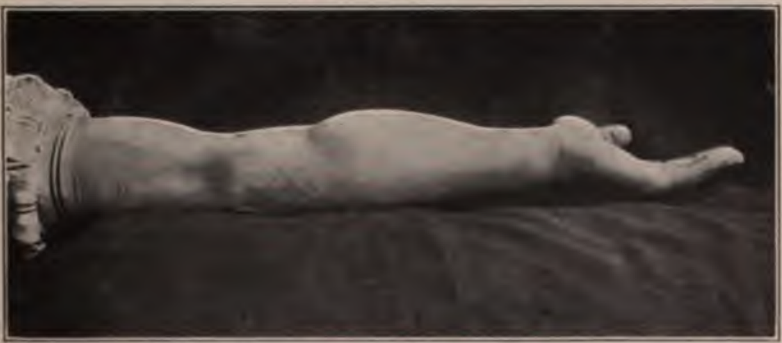

FIG. 231.—SIMPLE LIPOMA OF ARM.

Multiple Lipomata.—Lipomata of the arm, occurring in groups, appear to be hereditary. The tumors are situated in the subcutaneous plane of fatty tissue, and can be easily removed; but as they do no harm, and evince no tendency to malignancy, their removal is not indicated except upon esthetic grounds.

Fibroma and Fibrolipoma.—Fibroma occurs as a smooth, flabby, or firm tumor, either in or closely attached to the skin. It grows slowly, usually without pain. It is not compressible, as a varix is; it has a uniform consistence, and is covered by normal skin (Figs. 232, 233, and 234). A tumor of this character often gives a distinct wave of fluctuation, which is very deceptive. There is usually this difference, however: Fluid in a firm sac, if pressed upon, will give a much quicker fluctuation wave than when no outside pressure is applied. Outside pressure upon a solid tumor, such as a soft fibroma, has little effect upon its fluctuation wave, since the pressure is not at once distributed equally in all directions.

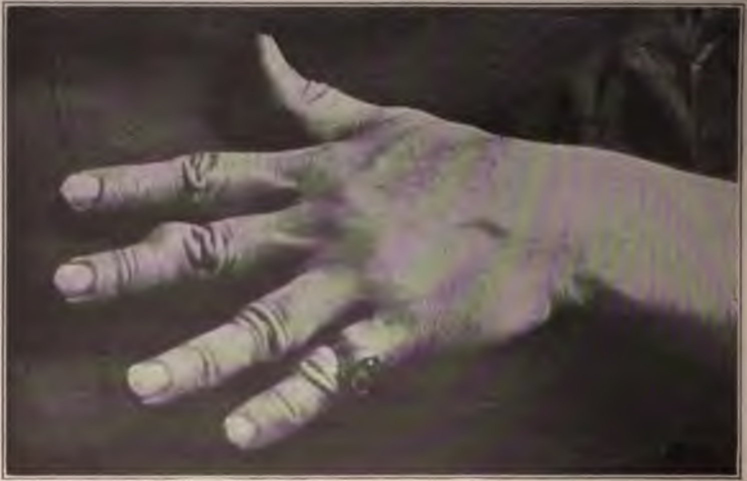

FIG. 232.—FIBROMA OF MIDDLE FINGER. Duration six years. Thought to have developed from the sting of some insect. Patient a man aged forty-five years.

A fibroma may contain fat, and is then often spoken of as a fibrolipoma. This makes a softer tumor than a pure fibroma. The differentiation between fibroma and lipoma is not very important, since the prognosis and treatment are similar.

It is, however, very important to differentiate fibroma and sarcoma. At an early stage of the latter this may be impossible except by microscopic examination. Both may be soft or hard.

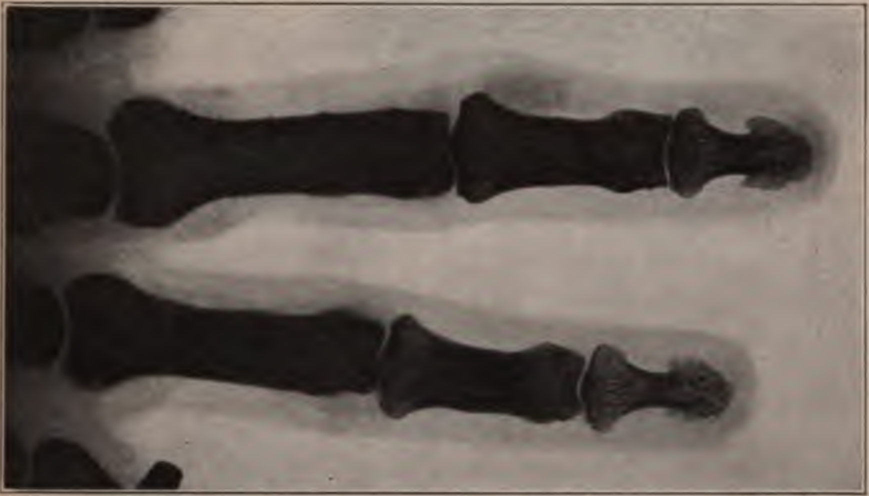

FIG. 233.—SAME SUBJECT AS FIG. 232. Radiograph showing the bone not to be affected. Compare Figs. 236 and 237 on pp. 455 and 456.

The safe plan is to remove every growing tumor, and to subject it to microscopic examination. The wound should be closed by

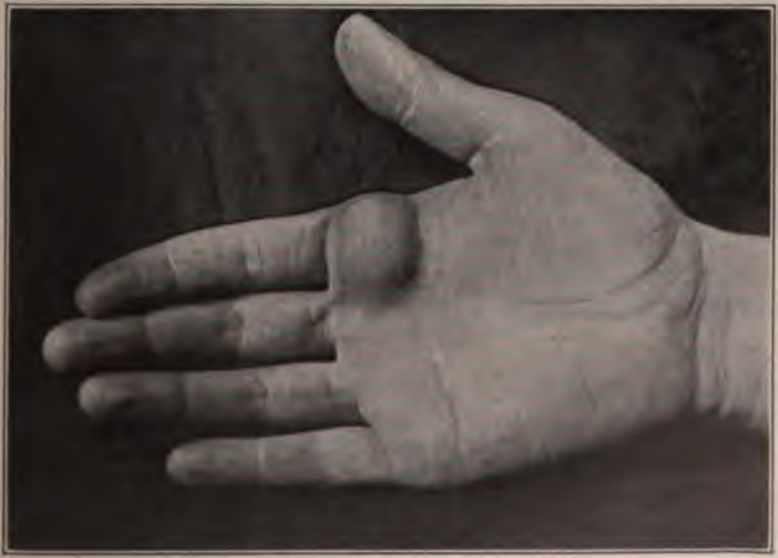

FIG. 234.—FIBROMA OF HAND.

suture, in order to await the report of the pathologist after his examination of numerous sections of the hardened tumor. In such a case it would be unwise to base the extent of operation upon an examination of frozen sections; for the similarity of fibroma to some forms of sarcoma is so great that a positive decision is difficult, even from the very best sections.

If it is found that the tumor is a fibroma no further operation is necessary, and the patient has been spared the unnecessary loss of time. If it proves to be a sarcoma, a further extensive removal of adjacent tissue will be necessary. It has been my experience that patients will almost invariably submit to a second operation, should such be found necessary, if the exact plan of procedure is explained to them before the first operation.

In some cases a fibroma may be mistaken for the lesions of tuberculosis or syphilis. Such a mistake is unlikely, and should soon be corrected by the progress of the inflammatory disease.

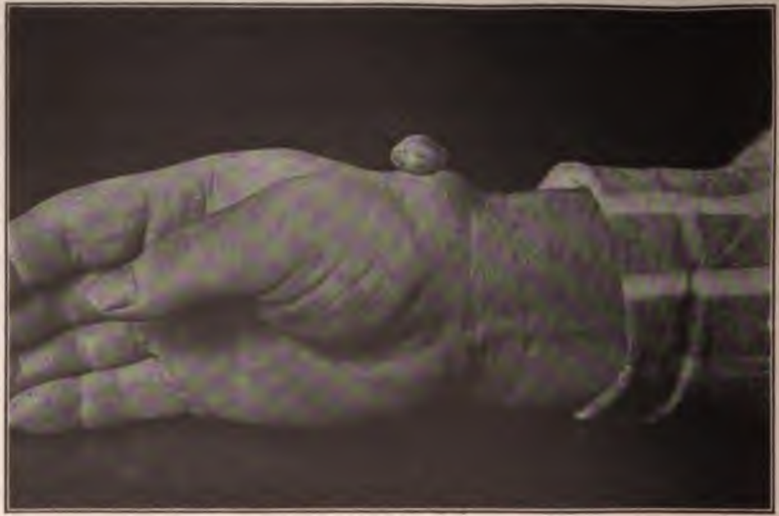

FIG. 235.—PAPILLOMA OF WRIST; FIBROLIPOMA.

A ganglion should be differentiated by the fact that it is covered by movable normal skin. The skin over a fibroma is closely attached to the tumor.

An inclusion cyst is to be known by its development in the palm, by its fluid fluctuation wave, and by its different consistency near its margin and at its center.

Finally, a fibroma may be so hard as to simulate an osteoma. The latter is of course immovable in the bone, while the fibroma is movable, at least to a short distance. Radiographs will clearly differentiate the two tumors (see Figs. 237, p. 456, and 239, p. 457).

Papilloma.—A fibrous and fatty tumor—in other words, a fibrolipoma—if pedicled, is called a papilloma. Such a tumor is covered with normal or slightly hypertrophied skin, and it is attached to the body by a neck smaller than the mass of the tumor (Fig. 235). This type of tumor is commoner upon the trunk than upon the extremities (see p. 185).

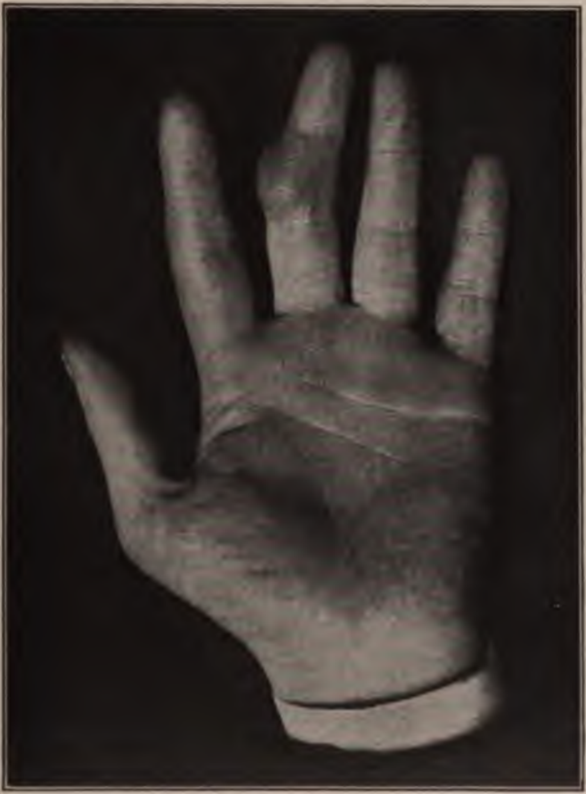

Fig. 236.—Osteoma of Finger.

Neurofibroma.—Contusion or wound of a nerve may lead to the development of a fibrous tumor in the nerve trunk. This form of tumor reaches its maximum growth in the stumps of nerves after amputation, and especially in the lower extremity. It is also found in the palmar nerves of the hand, under the circumstances mentioned, and sometimes causes the patient great pain.

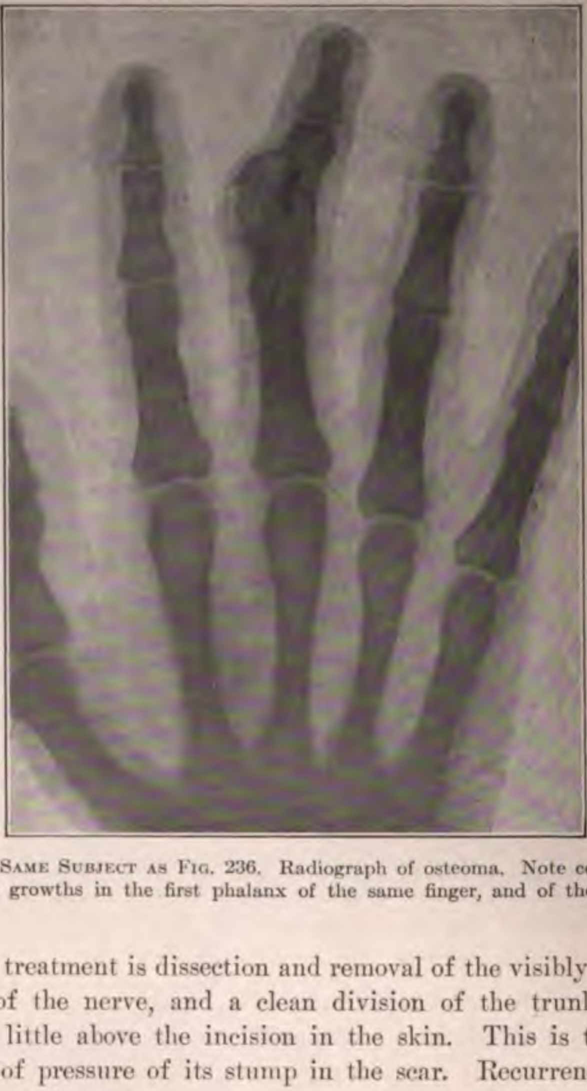

FIG. 237.—SAME SUBJECT AS FIG. 236. Radiograph of osteoma. Note commencing similar growths in the first phalanx of the same finger, and of the adjoining finger.

The best treatment is dissection and removal of the visibly affected portion of the nerve, and a clean division of the trunk of the nerve, a little above the incision in the skin. This is to lessen the risk of pressure of its stump in the scar. Recurrence sometimes takes place.

Osteoma.—Osteoma of a small bone has the same characteristics as osteoma of a large bone, viz., it is a hard painless tumor of slow growth, covered by normal movable skin, while it is firmly attached to the bone from which it grows (Figs. 236 and 237). It may be mistaken for a periosteal sarcoma, or a dense fibrolipoma. The former has usually a more rapid growth, and the latter is less hard, and always somewhat movable on the underlying bone. In such doubtful cases a radiograph is a necessity (Figs. 238 and 239). The radiograph of this osteoma is most instructive on another account. Careful inspection will show that two similar tumors were developing in the first phalanges of the second and third digits. Their presence was not suspected until the radiographs were made, but one of them was palpable when attention had been called to it.

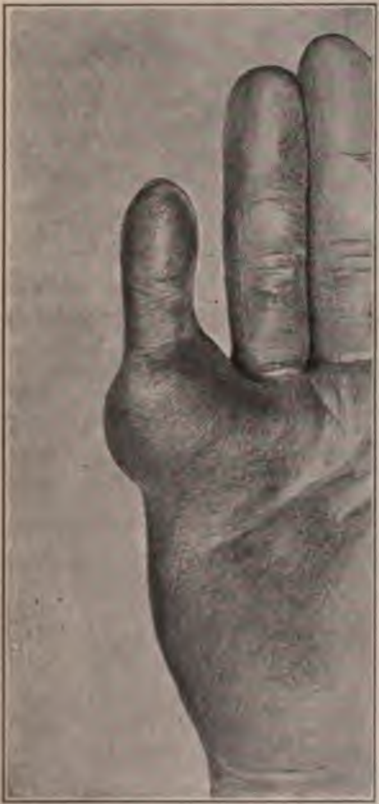

FIG. 238.—FIBROLIPOMA OF FINGER. Same subject as Fig. 239.

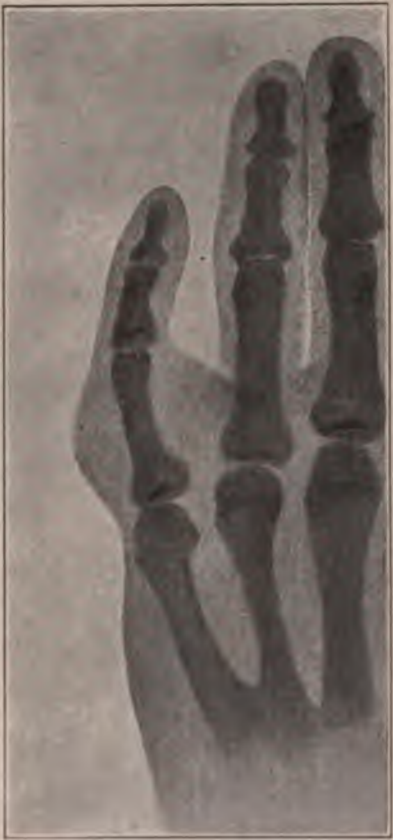

FIG. 239.—RADIOGRAPH OF FIBROLIPOMA OF FINGER SHOWING NORMAL BONES.

An osteoma should be removed. The skin is incised longitudinally at a distance from the tendons, and the osteoma exposed by dissection and retraction of the soft parts. The tumor should then be chiseled away. It is not necessary to remove the bone from which an osteoma springs, unless there is a suspicion of sarcoma; and even in that case it is better to await the result of the microscopical examination when one can act intelligently and as radically as the facts warrant.

Granuloma.—Granulations may grow above the surface of a wound, and prevent the epidermis from growing over the wound. Such exuberant granulations are spoken of as proud flesh. They may be cut away with scissors and the free bleeding stopped with pressure for a minute, or they may be burned down by touching them with solid nitrate of silver. If of long standing in a small wound, they become firmer in texture and pedicled in shape, and present somewhat the appearance of a sarcoma. Such a mass is called a granuloma (Fig. 240).

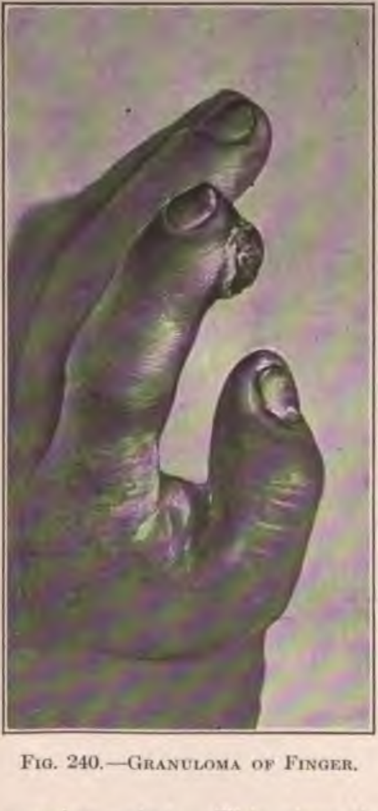

FIG. 240.—GRANULOMA OF FINGER.

A wart is a tumor of the epidermis, of papillary structure and usually elevated above the level of the normal skin. Warts usually develop in the skin of the hands, and during childhood, but they are also found in other situations and in adult life. Their cause is not known. If a wart is so situated that it can develop freely it may attain a height of one-eighth of an inch, and a diameter of one-third of an inch or more. The top is flat and shows numerous clefts between more actively growing points. This gives the surface of an old wart something of a cauliflower appearance (Fig. 241). If situated where it is irritated, for example, on the knuckle or along the nail, a wart is apt to crack and bleed and to give some pain. If situated under very tough epidermis, for example on the palmar side of the fingers or hand, the wart is often confined in its growth, so that its papillary character is less evident, and it appears more as a hard, tender tumor covered by thick epithelium and rising little above the skin surface. If the surface epithelium is shaved off, its true papillary structure will be evident.

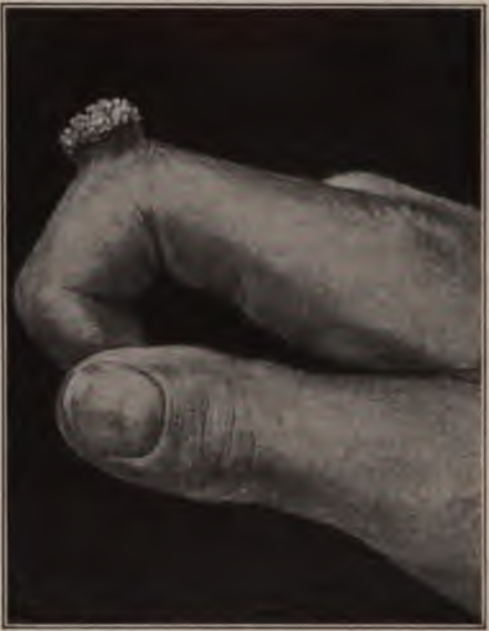

FIG. 241.—OLD WART OF INDEX-FINGER.

TREATMENT.—The warts that appear in large numbers on the backs of the hands of children, usually disappear spontaneously, or after some local treatment. Single warts occurring in adult life are not so easily dislodged. They may be removed by the knife (it is only necessary to remove the whole thickness of epidermis—not the corium), or by caustics. Monochloracetic acid is the best for this purpose. A small crystal should be picked up with a moistened toothpick and placed on the wart. The moisture will fuse the crystal without diluting it unnecessarily.

After three minutes, or sooner if the patient feels that it burns, it should be wiped away. In three days the burned tissue should be pared away and a drop of acid be applied to the living tissue beneath. This process should be repeated as often as is necessary until the wart, including its growing base, has been completely destroyed and removed. Too frequent applications of acid will make the part sore; too infrequent applications will allow the wart to grow in the intervals enough to make up for the partial destruction. A weaker caustic, such as a saturated solution of bichromate of potash, may be painted on every day. This treatment is more suitable to place in the hands of the patient himself. Treatment by acid, if judiciously carried out, is painless, avoids the use of any dressing, and the permanent loss of any skin. Treatment by the knife is quicker, but it necessitates a dressing and usually the loss of a bit of skin. If the wart is covered by thick epidermis (palm of hand, sole of foot), it can still be removed by acid, if the rules given are persistently carried out. Here, however, the two methods of treatment may be happily combined by injecting cocain and shelling out the wart with a curette, and cauterizing the base of the wound with acid before the anesthesia is over.

Epithelioma in the upper extremity usually develops on the back of the hand in an individual more than sixty years old. It may follow an injury, although usually there is no history of any traumatism other than the knocks and bruises to which the hand of a worker is frequently subjected.

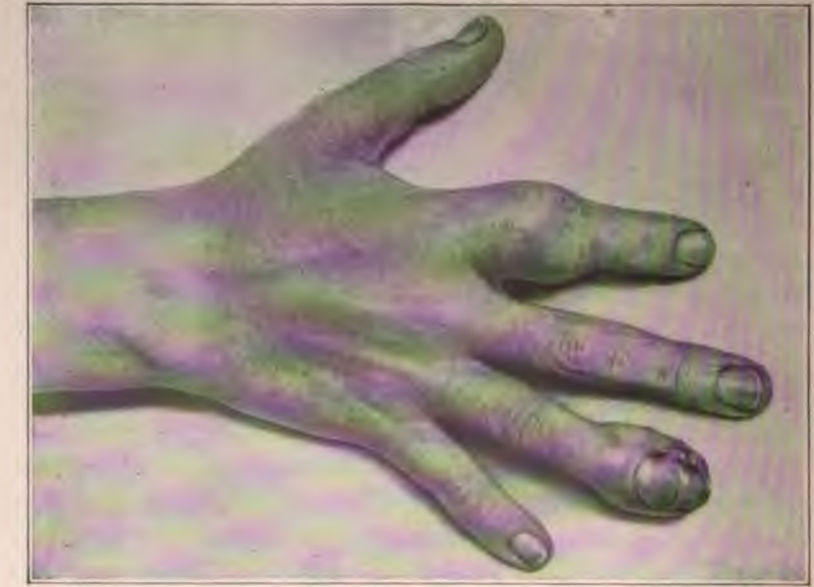

Fig. 242.—Metastatic Carcinoma of the Bones of the Hand from Carcinoma of the Breast.

More often it develops in one of the scaly patches so common on the hands of the aged. It is generally of very slow growth, appearing for months as a shallow ulcer which bleeds easily and may heal in part but not wholly; later the growing margin is more evident. Metastases do not form early, and it takes a long time for the growth to extend below the skin. Therefore, in most cases the removal of an elliptical piece of skin containing the ulcer will give a permanent cure. (For the details of such an operation see Chapter XX.)

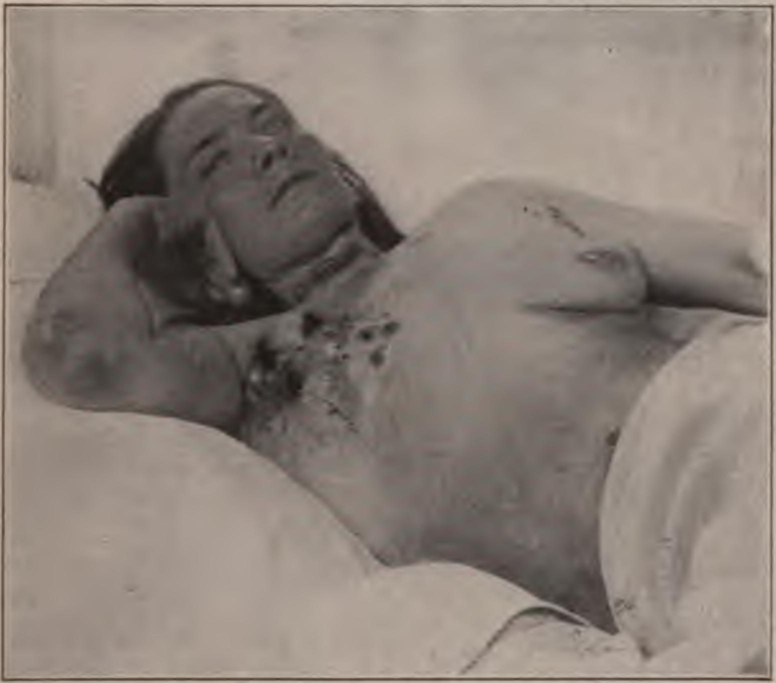

FIG. 243.—THE SITE OF THE ORIGINAL TUMOR OF WHICH THE TUMORS SHOWN IN FIG. 242 ARE METASTASES.

In giving a prognosis it is well to remember that any other scaly patch may undergo similar degeneration, so that this risk must be added to the slight risk of a recurrence after excision.

Carcinoma in the hand—a metastatic tumor from carcinoma in some other part of the body—is a rarer form of malignant growth. Such a case is shown in Figure 242, and the original tumor in Figure 243. There is, of course, no treatment for such metastatic tumors, unless pain or ulceration should make amputation desirable. Usually these symptoms are obscured by the more serious symptoms of the primary growth or metastatic tumors in more vital parts of the body.

Sarcoma.—A sarcoma is a connective tissue tumor, and is therefore found in every part of the body. In the upper extremity it usually originates in the skin or in one of the bones. In the former situation (Fig. 244), it must be differentiated from fibroma and fibrolipoma, and also from the lesions of syphilis and tuberculosis. Sarcoma of a bone may be mistaken for osteoma or enchondroma, and also for the lesions of tuberculosis and syphilis. It is true that mistakes in diagnosis are most likely to be made at an early stage of the growth, but it is just at that time that a complete removal of the growth is possible; therefore, an early exact diagnosis is most important. If this cannot be made certain in any other way, a section of the growth should be removed for microscopical examination.

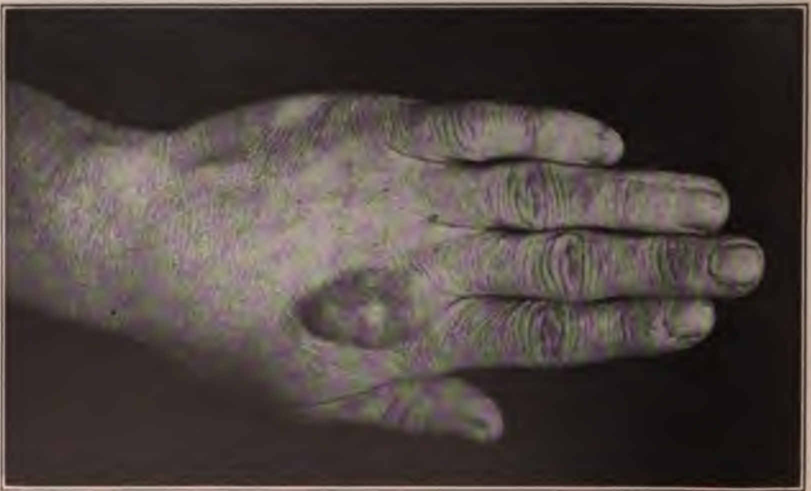

FIG. 244.—TUMOR OF HAND, SAID TO HAVE EXISTED TEN YEARS. The lesion was considered tuberculous, until the pathologist pronounced it spindle-celled sarcoma. The patient was a man aged thirty years.

The only treatment for a patient with sarcoma of the upper extremity is thorough removal of the tumor and the tissue from which it springs, even though an amputation of hand or arm be necessary to accomplish this object. (For minor amputations see p. 390.)

An operator is placed in a trying situation if he cuts into a supposedly benign growth, and finds from its appearance that it is probably a sarcoma. If it can be freely removed without the sacrifice of important structures, this is evidently the course to pursue. Usually the case will stand thus: The appearance of the tumor indicates malignancy, and yet a microscopical examination is necessary to determine this fact with certainty; the tumor is so situated that to cut wide of its margin will destroy some important structures. Under such circumstances the surgeon should remove a section of the growth for examination and close the wound, stating the case frankly to the patient. After the microscopic examination has been made the appropriate operation can be performed. This plan is far better than an imperfect removal of a sarcoma: for once the visible tumor is removed, the patient will almost certainly forbid a second operation in the hope that all of the tumor has been removed, and consent will not again be obtained until the tumor is palpably returning. In this way valuable time is lost, and the chance of radical removal lessened. The effect on the patient's mind is quite different when the surgeon explains to him before the first operation the possibility of malignancy and a second operation (see p. 453).

ACQUIRED DEFORMITIES

Cicatricial Contractions.—The usefulness and beauty of the hand is greatly impaired by the cicatricial contractions following burns and severe inflammations (Fig. 245). (See also Figs. 206 and 207, pp. 421 and 422.) If the damage is done in infancy, the deformity may actually increase with the growth of the parts. Hence the desirability of performing what restoration is possible before the fingers develop along abnormal lines. In many cases no treatment is indicated; in others plastic operations or skin-grafting may give a greater range of motion, or improve the position of the parts. In such cases there will always be a partial recurrence of the deformity, due to contraction of the new formed scar tissue.

A certain amount of contraction also follows the successful application of a Thiersch graft. Therefore if the raw surface which follows the dissection of the cicatrix cannot be covered by an attached flap of skin, a Wolfe graft should be employed. It will often be necessary to lengthen the tendons in order to

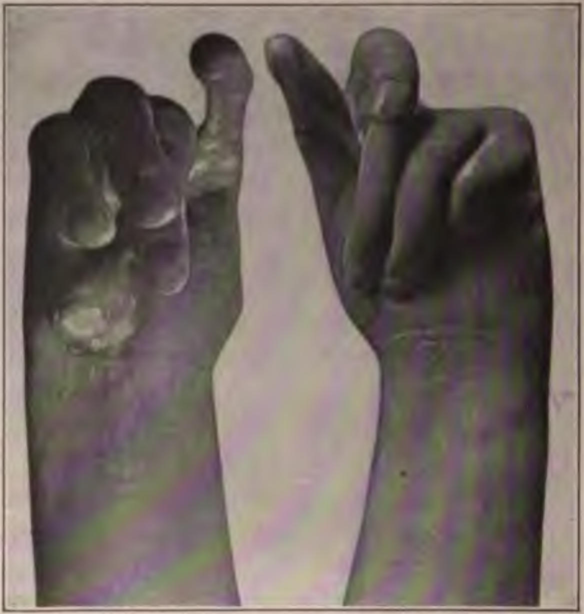

FIG. 245.—CICATRICIAL CONTRACTIONS FROM BURNS IN INFANCY.

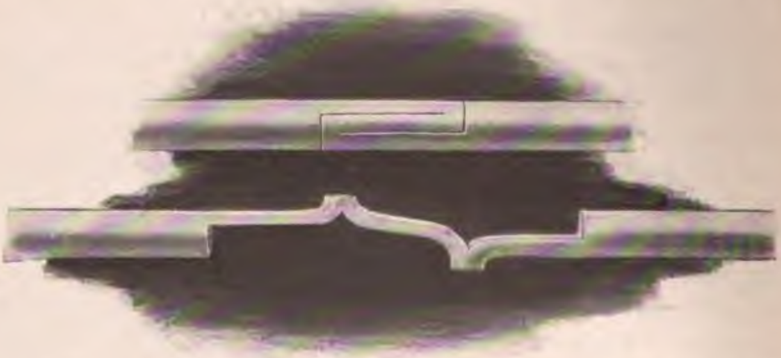

FIG. 246.—DIAGRAM TO SHOW A QUICK METHOD OF LENGTHENING A TENDON WITHOUT SUTURE WHEN THE TENDON IS OF SUFFICIENT SIZE.

obtain complete extension. This can be quickly accomplished without the use of sutures by making two overlapping L-shaped incisions in each tendon (Fig. 246). Or the tendon may be divided obliquely and sutured.

One should be careful not to sacrifice strength simply to gain a wider range of motion. A badly displaced useless finger is often justly amputated.

Dupuytren's Contraction.—This is a contraction of the palmar fascia, which comes on gradually in persons who work hard with the handle of an instrument in the palm. The fascia is thickened and drawn into distinct bands, which seem like cords extending to the various fingers, especially to the ring and little fingers. Complete extension of the fingers is then impossible (Fig. 247). The skin is puckered in places by the traction upon it from the contracted fascia.

The only satisfactory treatment of this trouble is the removal of the thickened fascia after its dissection from the skin, and the underlying structures. When the fascia is removed, the fingers can be extended. There is some tendency to recurrence of the condition, but in a less marked form, so that operation is amply justified. It is performed as follows: After local or general anesthesia, a longitudinal incision is made through the skin of the palm at the site of the greatest contraction. It should usually be from two to three inches long. The skin is divided as deep as the fascia, and the two skin edges are dissected away from the contracted fascia for about an inch on either side. This is the essential part of the operation. Care should be taken to keep these skin flaps thick so they will not slough. Next the thickened and contracted fascia is divided, dissected from the deeper structures to which it is attached by numerous septa, and removed.

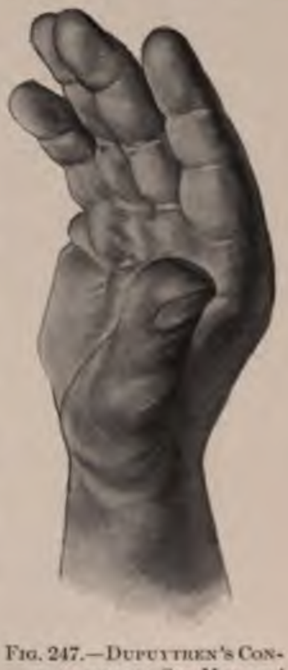

FIG. 247.—DUPUYTREN'S CONTRACTION OF SIX MONTHS' DURATION. Maximum possible extension of fingers shown. Note the puckering of the skin, where it is adherent to the thickened fascia.

The fascia is sometimes thickened into cords like tendons, so that one who is performing this operation for the first time may hesitate to cut them. There are two unmistakable differences. The tendons are always the color of ivory; the fascia is pearly white. The tendons never lie immediately beneath the skin as the fascia does. After removal of the fascia the wound should be sutured and the hand kept on a splint fully extended for several weeks. Active and passive motions should be made as soon as the wound has healed, but to prevent return of the contraction, full extension on a splint should be kept up a part of each day or at night for several weeks.

In slight cases multiple V-shaped incisions with forced extension will accomplish something, but this treatment is generally unsatisfactory on account of the intimate attachment of the skin and fascia.

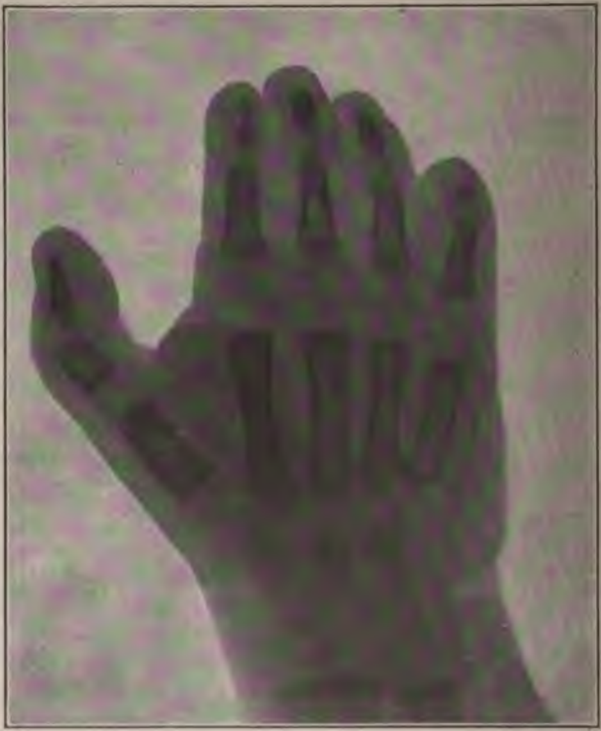

FIG 248.—RADIOGRAPH OF THE HAND OF AN INFANT, ALL THE BONES NORMAL, AND ALL THE FINGERS WEBBED The other hand was perfect.

CONGENITAL DEFORMITIES

There are four types of congenital deformity seen in the upper extremity, viz., *web-finger, supernumerary finger, hypertrophy*, and *deficiency* of one or more fingers, or some greater portion of the hand or arm.

Web-Finger.—Web-finger occurs in varying degrees. In the simple cases there is merely an extension of the normal web between the fingers, all of the bones of which are normally formed (Fig. 248). In severer cases the bones lie much closer together, or may be fused, or some of the bones may be wanting (Fig. 249). Web-fingers should be separated early by operation, so that as growth takes place the fin-

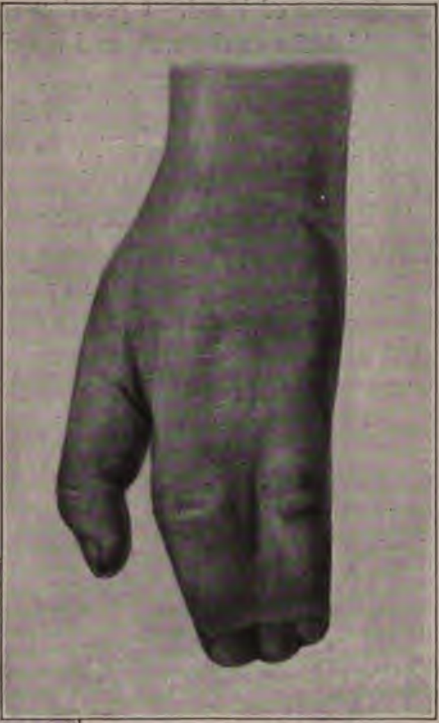

FIG. 249.—THE HAND OF CHILD SHOWING CONGENITAL DEFORMITY. One finger is missing, and the other is represented by its distal portion only, the nail and terminal phalanx of which are closely joined to its fellow. Drawn from a photograph.

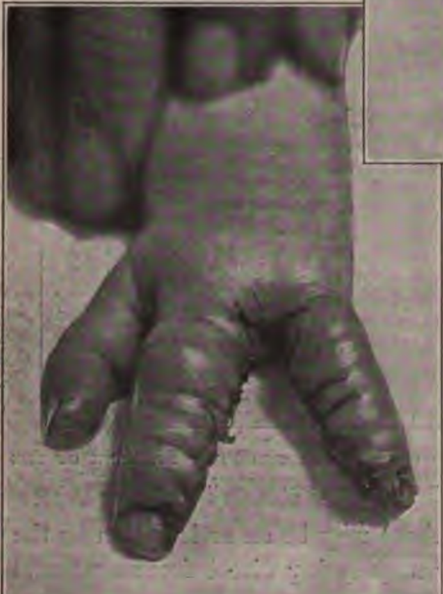

FIG. 250.—INCISION AND SUTURE FOR WEB-FINGER. The incisions are not made in the best situations. One should be more palmar and one more dorsal. Same subject as Fig. 249.

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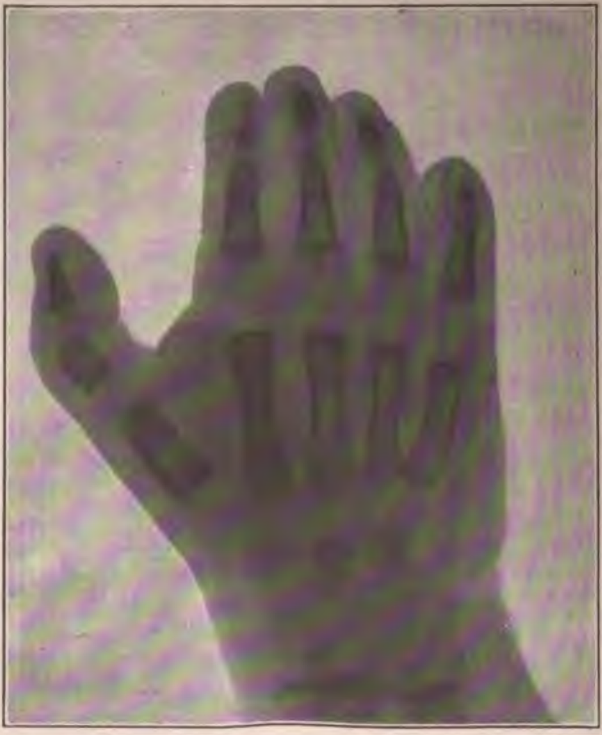

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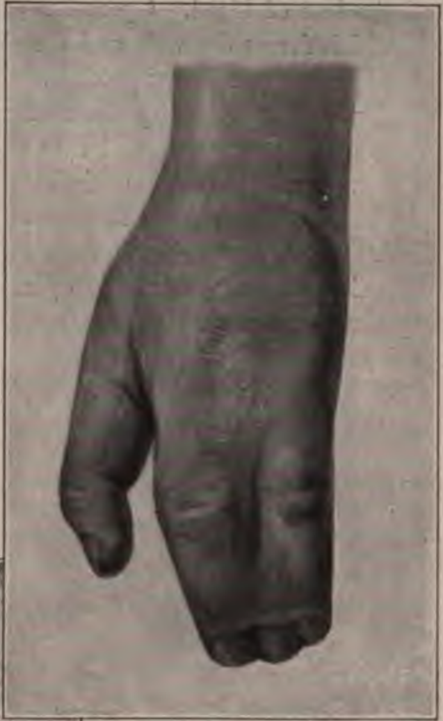

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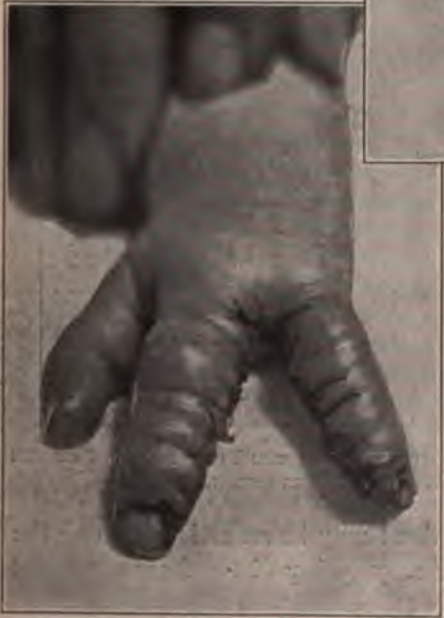

FIG. 250.—INCISION AND SUTURE FOR WEB-FINGER. The incisions are not made in the best situations. One should be more palmar and one more dorsal. Same subject as Fig. 249.

dons together and add to the strength of the hand when used as a whole, greatly impede the action of the individual fingers. For some occupations and in some persons they may fairly be considered congenital deformities. The ring-finger (fourth digit) suffers the most, as its extensor tendon often has branches extending to those of the middle and little fingers. Full extension of the fourth digit is then impossible unless the third and fifth are at least partially extended. This is a distinct disadvantage for one who would play the piano or violin, and pupils often spend many weary hours trying to increase the range of motion of the affected finger. Some gain in motion may follow such practise, especially at an early age, but a far better plan is the removal through a short incision of the limiting accessory tendons. This slight operation will at once greatly increase the range of extension of the finger which is freed and will not materially weaken the hand. The operation is performed as follows:

After preparation of the skin and injection of cocain, a longitudinal incision should be made through the skin directly over the accessory tendon to be removed. Its sheath should be exposed and opened, and at least an inch of the accessory tendon should be resected, so that it may be cut off flush with the sheath of the main tendon. The sheath of the accessory tendon should also be resected and the cut ends closed, each by a stitch or two of fine catgut. The skin wound should be closed by interrupted sutures or a subcuticular one (p. 573), and a dry gauze dressing applied. The stitches should be removed in five days.

The resection of the accessory tendon sheath, and the closure of its cut ends, is to prevent the reformation of the accessory tendon. Even if this does take place it is several weeks before the new tendon becomes firm, and during this period the patient has an opportunity to extend the finger in question to a far greater extent than formerly. The gain thus made will be largely permanent. Exercises should be begun a few days after the wound in the skin has united—say in ten days.

SECTION VII

AFFECTIONS OF THE LEG AND FOOT

CHAPTER XVII

INJURIES OF THE LEG AND FOOT

Contusions and Abrasions.—Contusions and abrasions of the lower extremity are perhaps oftenest found upon the shin. The circulation of blood is less active in the leg and foot than in any other part of the body; hence, wounds do not heal as readily in these parts, and bruises or slight breaks in the skin, trivial in themselves, may become starting-points for serious inflammations. Therefore, every injury of the lower extremity should receive prompt and efficient treatment. If it is situated below the knee, the skin should be carefully cleansed, and a dry gauze dressing or a moist antiseptic dressing should be applied to it, and the limb bandaged from the toes to the knee, at least until repair is well started. As the heel never swells much, it should be left bare, unless it is wounded. Such a bandage will prevent edema and facilitate the circulation of the blood in the limb. Above the knee the circulation is better, and repair takes place more rapidly.

Blister.—Unaccustomed exercise and ill fitting shoes are responsible for most of the blisters which develop on the foot, usually on the heel and toes. They may contain clear serum or bloody serum. Often they have been broken accidentally or intentionally before the doctor sees them. The fluid should be evacuated from the others by the passage of a sterile needle obliquely through the sound skin at the edge of the blister. Cleanliness should be extreme in order to avoid infection. Tender and abraded surfaces should be treated by cold cream, or by a moist antiseptic dressing, according to the severity of the lesion. Cold bathing and rubbing the sound skin with alcohol will toughen it and render less likely the formation of blisters.

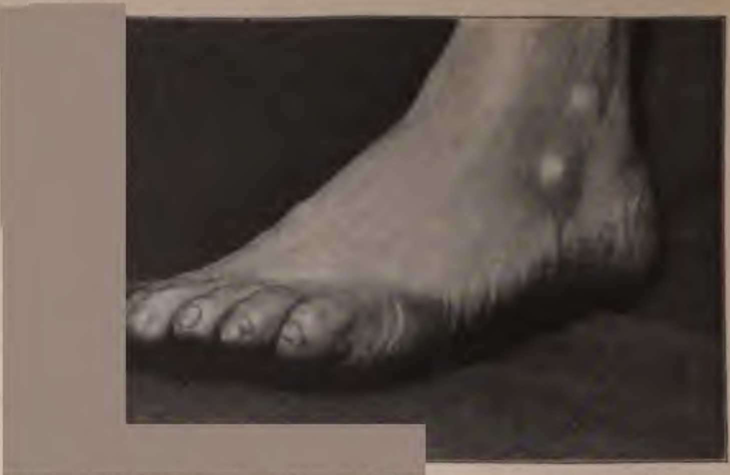

FIG. 253.—HEMATOMA OF FOOT PRODUCED BY A SLIGHT TURN OF THE ANKLE. Photograph six hours after the accident.

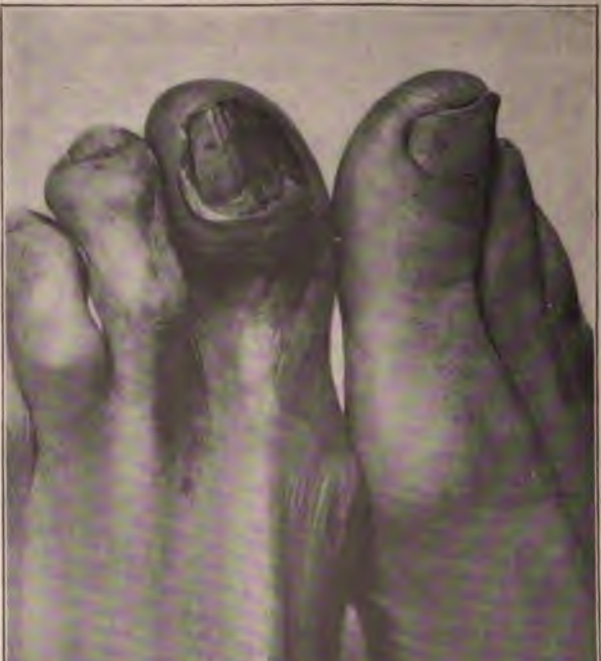

FIG. 254.—HEMATOMA UNDER LEFT GREAT TOE-NAIL. Note the elevation of the nail beneath the skin as far as its matrix.

Hematoma.—For the diagnosis of a hematoma the reader is referred to page 2. If the amount of effused blood in a hematoma is small (Fig. 253), it may safely remain undisturbed for resorption. If the quantity of blood is large, it should be removed through a longitudinal incision, and the wound sutured. If the patient is first seen some days after the injury, the blood clot may have softened sufficiently to permit its extraction through a large hollow needle.

Hematoma under a toe-nail (Fig. 254) presents the same symptoms and demands the same treatment as hematoma under a finger-nail (p. 325).

Subperiosteal hematoma (Fig. 255) is less easy to diagnose, since it may exist without discoloration of the skin. It is usually due to a direct blow. It gives a tense, rounded, fluctuating, tender swelling, immovable on the bone, and covered by movable skin. It must be differentiated from a contusion of periosteum (less

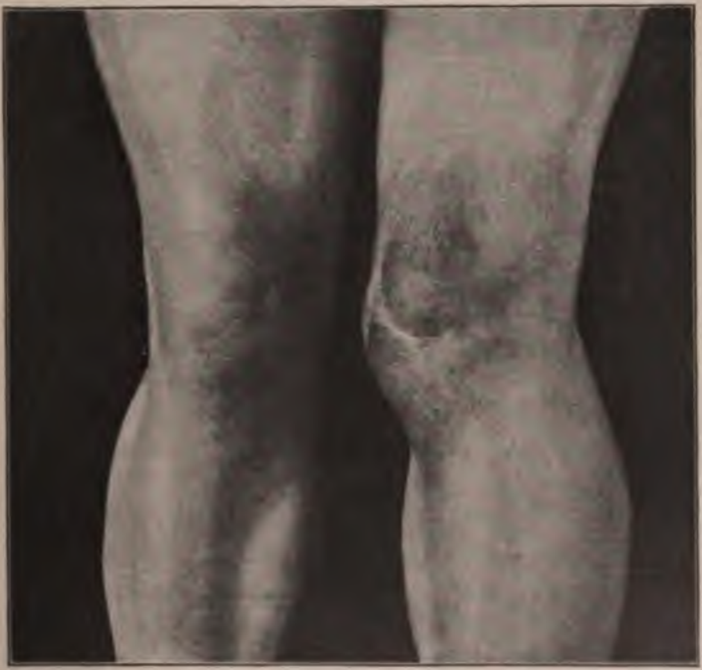

FIG. 255.—SUBPERIOSTEAL HEMATOMA OF THE HEAD OF THE TIBIA; THREE WEEKS OLD FROM TRAUMATISM. The joint was not involved and contained no fluid. Patient a man aged forty years.

swelling and no fluctuation); from a serous effusion under the periosteum (different fluid on aspiration); from a subperiosteal abscess (greater tenderness, edema of surrounding tissues, fever, etc.); from a fracture (usual signs, especially pain on pressure made on the two ends of the bone, radiograph); from syphilitic gumma; from tuberculous osteitis, and from sarcoma. The three last mentioned lesions develop gradually, and often without traumatism. Under certain circumstances fluctuation is present in all three, but the fluid, if aspirated, will be, in the case of gumma, a straw or orange colored thin sirup; in tuberculous osteitis, a thin, flaky pus; and in sarcoma, pure fresh blood; while the fluid from a hematoma is dark, abnormal blood. The radiographs of the three lesions are also different, and a gumma will often diminish very much in size after a few days' treatment with potassium iodid. The treatment of hematoma is given above. After either aspiration or incision a firm bandage should be applied to prevent recurrence.

Rupture of a Vein.—Rupture of a vein of the leg may be followed by a serious loss of blood. The vein which bursts is always varicose, and the overlying skin is much atrophied on account of this varicosity. A previous ulceration and cicatrization may also be present, though this is not necessary. The rupture of the vein usually follows some slight traumatism. The opening is small, and light pressure applied directly to it readily controls the bleeding. The wound should be cleansed (p. 13) and a sterile gauze compress bandaged over it and left in place for a few days. Ligation of the vessel is not often called for. To perform this operation, make a skin incision parallel to the vein, free the vessel for a half inch or more, pass a double catgut ligature about it, tie it above and below the rupture, and then cut the vein in two. Suture the incision in the skin and apply a dry dressing.

Subcutaneous rupture of a vein also occurs, due either to direct violence or to indirect violence. When it is due to a sudden strain or to a fall, the presence of effused blood may lead to a false diagnosis of fracture. For the treatment of the resulting hematoma see page 3. If hemorrhage continues in spite of pressure, a free incision should be made and the bleeding vessel exposed and ligated. The wound should be sutured.

Rupture of Tendon.—The slender tendon of the plantaris muscle sometimes snaps as the result of sudden tension. This accident causes a sharp pain in the back of the leg, as if a smart blow were given with a stick. Soreness and lameness follow, lasting a few days. There may or may not be a slight ecchymosis appearing on the surface after a few days. The only treatment required is warm bathing and rubbing, to overcome the soreness. The accident is not a common one.

Wounds.—While there is nothing peculiar in the diagnosis of wounds of the lower extremity, it is desirable to emphasize the importance of thorough treatment of even trivial wounds when they occur in the aged or others whose circulation is not the best. Many intractable ulcers of the leg and serious infections of the foot start in wounds which would have healed promptly had rational treatment been given them. An old physician once said to the author: "No man ever performed an operation for cataract more carefully than I cut my corns." He was a diabetic, and had good reason to be careful; but infection and ulceration follows carelessly treated wounds of the foot and leg in many persons whose resistance has been decreased by nephritis, heart disease, anemia, repeated childbirth, and other causes.

Three common illustrations of the serious trouble which may develop from infected wounds are: Ulcer of the leg from a wound of the shin; suppuration in the first metatarsophalangeal joint from a wound of the overlying bursa; perforating ulcer of the foot from a wound by the side of a callus of the sole of the foot.

Punctured Wound of a Joint.—There are a few special structures which may be injured in wounds of the lower extremity. The knee-joint may be opened by a wound at either side of the patella, or either side of the quadriceps tendon; the ankle-joint may be opened by a wound behind, below, or in front of either malleolus; the first and fifth metatarsophalangeal joints may be opened by wounds at the side of the respective joints. If the wound of a joint is small and made by a clean instrument, the only symptom may be the escape of viscid fluid. In most cases there will be, however, some signs of irritation, such as swelling of the joint, increased fluid in it, tenderness on manipulation, and a limitation of motion on account of pain. If the infection is severe, there will be great edema and pain, high fever, chills, etc.

In the usual case, if the wound is recent, it should be explored up to the joint capsule. If there is reason to believe that the joint has not been infected, a drain should be so placed as just to reach the capsule of the joint, and the superficial wound should be closed. If there is reason to suppose that foreign material has been carried into the joint, or if infection is already present, the joint should be irrigated and drained through a second incision, if necessary. (See p. 332.)

Division of Tendons or Nerves.—Every wound should be explored for the sake of cleanliness and for the suture of tendons and nerves which may have been divided. This complication is most likely to follow wounds behind a malleolus or at the front of the ankle. The directions for suturing a divided tendon and nerve are given on pages 332 and 334.

Bursitis.—There are numerous bursæ in the lower extremity. More than twenty are described in the vicinity of the knee-joint, but most of them perform their function so perfectly that they never come to the notice of patient or surgeon. Of all the bursæ of the lower extremity, the prepatellar bursa is most often affected, and on this account, and because its reactions are typical, its lesions will be first described.

Acute Prepatellar Bursitis.—This affection is often seen in persons who work on their knees, scrubbing floors, laying carpets, etc., but is by no means confined to them. While it is true that a person kneels on the tubercle of the tibia rather than on the patella, yet the latter is constantly bruised and strained in reaching or crawling forward. The knee of a woman who scrubs for a living shows two calluses, one over the tibial tubercle and one at the lower margin of the patella, unless these two are fused in one large callus.

If the prepatellar bursa is distended with fluid, serum, or pus or blood, it plainly fluctuates. Sometimes the bursa is situated directly in front of the patella, but usually it covers only the lower half of this bone, and may extend over a part of the patellar ligament. Such variations in situation have no surgical importance. It is of the greatest importance to distinguish fluid in the prepatellar bursa from fluid in the pretibial bursa, situated behind the patellar ligament, and from fluid in the knee-joint itself. It is easy to do this if the patient, lying or sitting, is able to extend the leg horizontally. The increased tension of the patellar ligament will obscure fluctuation within the area covered by the ligament, provided that the fluid lies behind it, although fluctuation at the sides may be made more distinct thereby. If the fluid lies in front of the ligament or patella, fluctuation will not be affected by extension of the leg. The fat behind the patellar ligament being more or less confined, often fluctuates. If edema is present, the result of trauma, comparison of the two knees may fail to clear the diagnosis. A few days' rest will reduce a swelling due to a traumatic edema, but will not cause the disappearance of a bursitis.

The physical signs of bursitis are these: A well localized fluctuating swelling covered by movable normal skin; only slight tenderness and pain; little disturbance of the functions of the adjacent joint (Fig. 256).

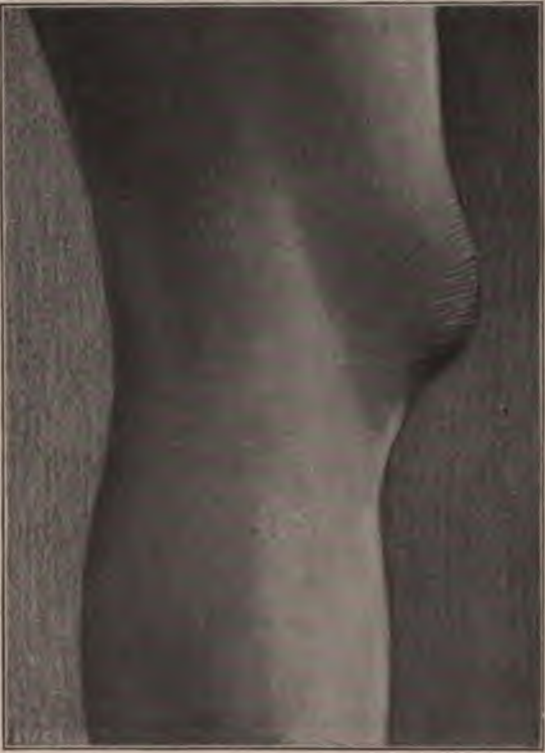

FIG. 256.—PREPATELLAR BURSITIS.

Suppurative Prepatellar Bursitis.—If the bursa is infected, the contained fluid will be purulent; there will then be edema and redness of the tissues outside of the bursa, and pain and tenderness and impairment of function will be proportionately greater. The lesion must then be differentiated from an abscess in the subcutaneous tissues outside the bursa. In this case the swelling will not be so sharply limited, and will probably not correspond so exactly to the situation of the bursa. For example, an abscess in the front of the knee will probably lie more to one side than the other, whereas swelling due to suppuration in the prepatellar bursa will extend equally toward both sides. It is of course possible for suppuration in a bursa to break through the sac and extend into the subcutaneous tissue. In the case of the prepatellar bursa, such rupture is usually through the skin (Fig. 257).

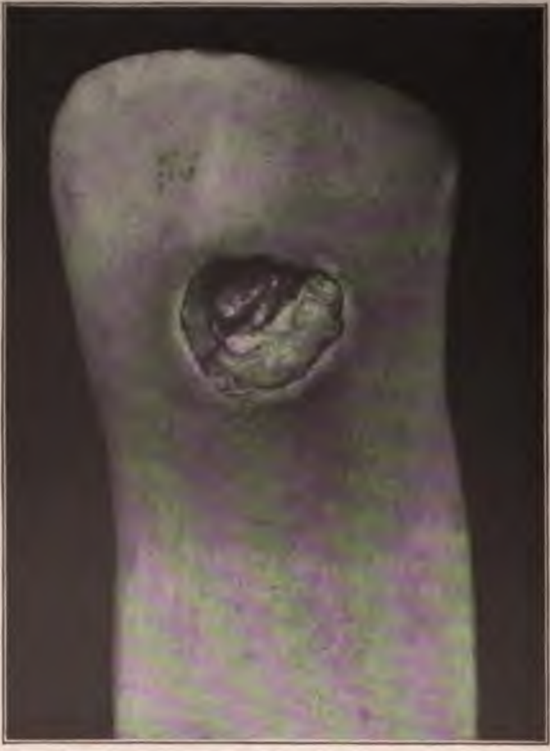

FIG. 257.—SUPPURATION IN PREPATELLAR BURSA; RUPTURE THROUGH SKIN FIVE WEEKS BEFORE PHOTOGRAPH; REPAIR BY GRANULATION TAKING PLACE IN LOWER PORTION OF CAVITY. Patient a man aged seventy years.

Chronic Prepatellar Bursitis.—The acute bursitis may subside, the fluid being absorbed. Usually the sac is slightly thicker than before. With repeated traumatisms, and reaccumulations of fluid, this organization of fibrous tissue inside the sac may go on until its cavity is nearly or quite obliterated, and a slightly elastic fibrous tumor occupies the site of the bursa. Such a tumor is usually painless, but gives a permanent disfigurement. Figure 258 shows a bursa in process of organization, removed by operation, and split open. Numerous buds of granulation are seen, one of which, lying across the blades of the forceps, is almost long enough to attach itself to the opposite wall. Two other processes, one slender and one thick, both of which are also lying on the blades of the forceps, have already become so attached.

Treatment of Prepatellar Bursitis.—If there is uncomplicated prepatellar bursitis, palliative treatment is permissible. Limitation of motion by a bandage or a posterior splint; pressure upon the bursa by a bandage or adhesive strapping; moist applications or an ice-bag to relieve pain; and counter-irritants such as tincture of iodin or guaiacol, are suitable remedies. If the fluid does not diminish in amount, it may be withdrawn by aspiration, and the part tightly strapped with adhesive plaster; or twenty minims of a mixture of equal parts of carbolic acid and camphor may be injected into the bursal sac. This will sometimes cause the disappearance of the fluid, even without aspiration. As it can be injected through a small hypodermic needle, it is a less formidable procedure than aspiration, which to be thorough requires a good sized needle. Treatment by injection, if successful, leaves a thickened bursa.

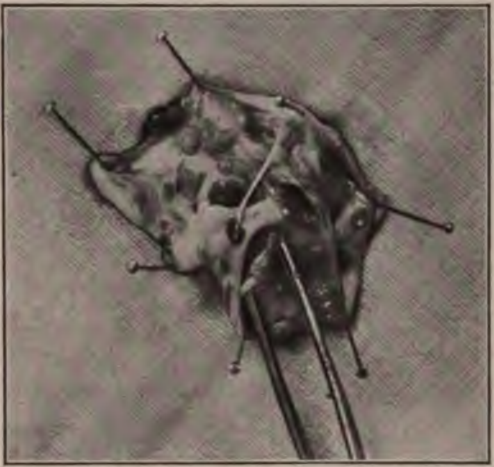

Fig. 258.—Proliferative Prepatellar Bursitis. Bursa removed by operation and split open. Note the granulating processes of various lengths, some of which have already become attached at both ends. Said by the pathologist to be tubercular. Same patient as Fig. 256.

If the bursa is infected, it should be split longitudinally throughout its whole extent. This may be done under cocain or nitrous monoxid. The cavity should be lightly filled with gauze, which should remain for several days to favor granulations from the whole of the lining of the bursal sac. When this has been accomplished, the gauze may be removed, and the skin edges gradually brought together by strips of adhesive plaster, space being left between them for drainage. In certain cases a secondary suture of the skin is advisable.

The best treatment for chronic serous or fibrinous bursitis is dissection of the bursa (Fig. 259) and suture of the skin. This operation demands a general anesthetic in most cases. It is easy to free the anterior surface and sides of the prepatellar bursa with the help of a local anesthetic, but its base is very adherent to the patella or ligament, and the pain of this dissection is not easily stilled by eucain or cocain. Another reason for the removal of a chronically involved bursa is the possibility of tuberculosis.

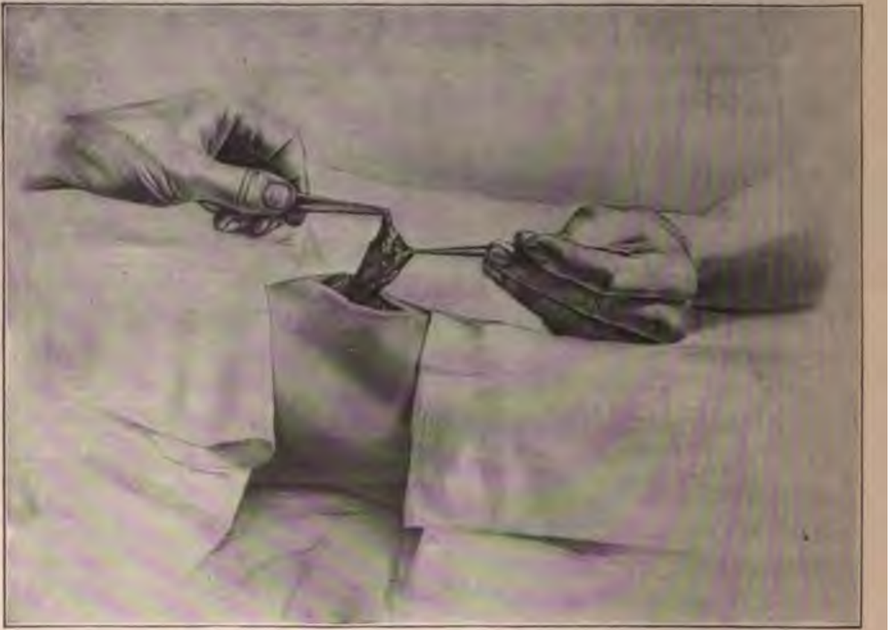

FIG. 259.—DISSECTION OF PREPATELLAR BURSA, INVOLVED IN CHRONIC INFLAMMATION, IN THIS CASE PRONOUNCED TUBERCULAR BY THE PATHOLOGIST. Same subject as shown in Fig. 256. Drawn from a photograph.

Subgluteal Bursitis.—One of the bursæ in the vicinity of the hip may become inflamed as the result of traumatism or tuberculosis. The bursa most often so involved is situated beneath the gluteus maximus muscle. It gives a slight oval swelling with a little tenderness and limitation of the motions of the hip-joint. It may therefore be mistaken for hip-joint disease; or, as stated above, it may be a complication of hip disease. In every case, therefore, of bursitis of this region, even if it follows a traumatism, it is well to bear this fact in mind.

The Bursa Gastrocnemio-Semimembranosa.—There are other bursæ of the lower extremity which become enlarged with sufficient frequency to make them important. One is the bursa under the tendon of the semimembranosus. When distended, a part of this bursa is palpable in the popliteal space, while the rest of it is hidden beneath the inner hamstring tendons. A mistake in diagnosis ought not to occur. A popliteal aneurism occupies the middle of the popliteal space and pulsates. An abscess is accompanied by the acute signs of inflammation, which are lacking in distention of this bursa; and even a cold abscess will be accompanied by some local tenderness and loss of function, referable to the source of the pus.

The only treatment worth considering is the removal of the bursa by dissection. This is not a serious operation, but it demands a general anesthetic and several days' rest in bed. In about one person in five this bursa communicates with the knee-joint, a fact which is no contra-indication to operation.

The Bursa Under the Tendo Achillis.—The small bursa between the tendo Achillis and the os calcis sometimes becomes inflamed as a result of excessive exercise or a fall or blow; or the trouble may come on more gradually, as a complication of gout, rheumatism, etc.

The chief symptom is pain at the back of the heel, so that the name achillodynia has sometimes been applied to this bursitis. The pain may be continuous, or it may be excited by contraction of the muscles of the calf when the patient bears his weight upon the ball of the foot. The easiest gait under the circumstances is to rotate the leg outward, and to avoid flexion and extension of the ankle.

Treatment consists in the application of heat and counter-irritants; in the removal of pressure by splitting the heel of the shoe or wearing a slipper; in disuse of the foot and in fixation of the ankle-joint by adhesive strapping or in more severe cases by the use of a plaster of Paris splint. In chronic cases complete excision of the bursa is indicated through two short incisions, one on either side of the tendo Achillis. A plaster of Paris splint should be applied to insure recovery with the foot in a correct position, i. e., flexed at least to a right angle and slightly inverted.

Metatarsophalangeal Bursitis; Bunion.—A bursa lying between the skin and the head of the first metatarsal bone is exposed to pressure from a shoe, and often becomes inflamed. This bursitis is commonly called a bunion, although this term is used to indicate any painful swelling about this metatarsophalangeal joint. The corresponding bursa of the fifth metatarsal bone may be similarly affected (Fig. 260).

The inflammation in the bursa may subside, leaving its walls slightly thickened, and subject to a recurrence of the attack. Or if the inflammation is suppurative, the overlying skin may rupture and allow the escape of pus and mucus. The resulting sinus may heal, or it may persist, or it may close from time to time, only to break open as the fluid reaccumulates in the bursa. As the bursa often communicates with the metatarsophalangeal joint, the cavity of this joint frequently becomes involved in the inflammation, which may lead to necrosis of the metatarsal bone. This complication is most apt to occur in cases of hallux valgus. Indeed this bursa is rarely inflamed except in cases of hallux valgus.

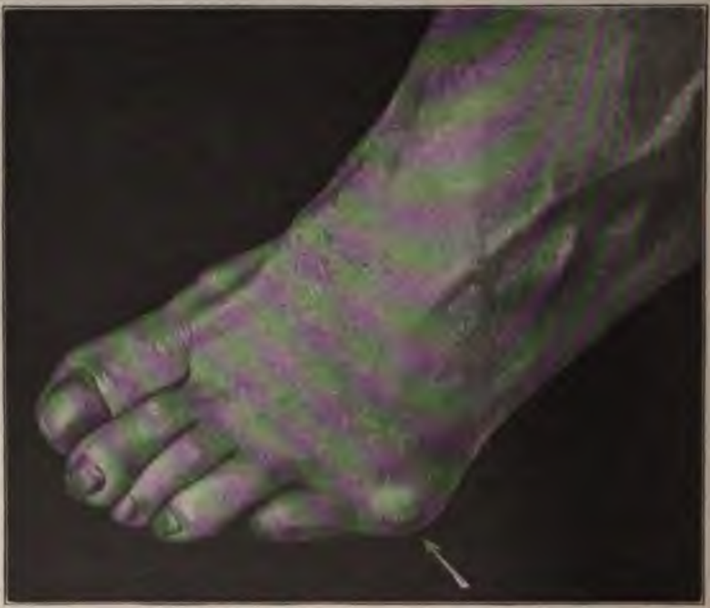

FIG. 260.—INFLAMMATION OF THE METATARSOPHALANGEAL BURSA ON THE OUTER SIDE OF THE FOOT.

TREATMENT.—Mild cases of bursitis may be allowed to subside. The affected part should be protected from pressure by a bunion plaster, and pain should be controlled by counter-irritants, such as iodin, guaiacol, menthol, etc. Moist and dry heat both give the patient great relief.

If the bursitis is suppurative the cavity of the bursa should be freely drained by a longitudinal incision to the plantar side of the bursa, or the whole bursa may be removed by dissection. In either case the wound should be drained, and the toe kept at rest by a plantar or lateral splint, so padded as not to press upon the inflamed part (Fig. 299, p. 553). If the joint is seriously involved, resection of the head of the metatarsal bone will give the best drainage, and will at the same time enable the surgeon to correct the deformity of the hallux valgus (see p. 550).

Serous Synovitis.—The majority of cases of serous synovitis are of traumatic origin, and are discussed under the heading " Sprain," pages 486–496, where methods of diagnosis and treatment are given. Serous synovitis not due to injury occurs in rheumatism and gonorrheal arthritis, though the process in these diseases is usually an arthritis, all of the tissues which surround the joint being involved. It also occurs in acute infectious diseases, and in gout, syphilis, and tuberculosis; and occasionally in tabes dorsalis (Charcot's joint), and under some circumstances in which no definite cause can be assigned. In many of these cases the collection of serum in the cavity of the joint is only an early stage of an inflammation, which soon becomes purulent, or it is an accompaniment of a deeper process, as in tuberculosis, tabes, etc. Hence every effort should be made in these non-traumatic cases to make a complete diagnosis, and not to rest satisfied with the diagnosis of serous synovitis. The location of the fluid, whether in the joint, in some bursa, or diffuse in the soft tissues; and the presence of accompanying cellulitis should be determined. The amount of pain on manipulation, and especially the presence of pain produced by crowding together the cartilaginous ends of the bones, without flexing or extending them, is of importance as showing the extent to which inflammation has involved the bones. The circumference of the joint and of the limb above and below it should be compared with the sound limb and recorded for future reference. Similar note should be made of the limitation of flexion and extension, and whatever other motion the joint has normally. The patient's temperature should be taken several times, for a day or so at least, and if circumstances permit, the blood should be examined, and fluid aspirated from the joint should be tested for bacteria. Our knowledge of joint diseases is so imperfect that no opportunity should be lost by which clinical data may be added. Finally, there is the test of treatment, and especially the effect of rest, and of the salicylates and of iodid of potash.

The treatment of traumatic synovitis is outlined on page 493. The measures there indicated are, rest, obtained by strapping with adhesive plaster or by the use of splints or by remaining in bed; elastic pressure to favor the resorption of the fluid; ice to control pain; massage or counter-irritation to stimulate circulation. These measures are equally beneficial in non-traumatic serous synovitis. Massage and passive or active motion should not be employed as long as an active inflammatory focus exists. Aspiration of fluid has a curative as well as a diagnostic value. In sluggish cases it may be followed by the injection of a three per cent solution of carbolic acid. If clots or fibrin prevent the escape of the joint contents, saline should be injected and withdrawn, and this repeated until the joint is clean. The importance of absolute asepsis in aspiration or irrigation cannot be too strongly emphasized. Immediately after the aspiration pressure should be applied to the joint.

Chronic Serous Synovitis.—If the knee or ankle is subjected to repeated traumatisms, the condition of the joint may become chronic. It is then desirable to use counter-irritants in addition to the measures spoken of above. The actual cautery is one of the cleanest and best. Tincture of iodin, iodin ointment, and cantharidal collodion are other efficacious remedies. The counter-irritation should be repeated in three days or one week, according to depth of irritation produced.

Floating Cartilage.—Patients sometimes complain that the knee catches in walking, or in going up or down stairs, giving more or less pain, and requiring some manipulation before it will work again. Sometimes a clear history of injury is given; more often this is not the case. Such mechanical difficulty may be due to a loose cartilage (Fig. 261), a body found only in the knee-joint, and whose origin is not satisfactorily accounted for; while sometimes a loosened meniscus plainly slips from its normal situation and gets caught between the bones; and sometimes one can only speculate as to the cause of the trouble.

A joint which suffers from such repeated small injuries naturally becomes weakened, and usually contains a little fluid. If there is a loose cartilage, freely movable in the joint cavity, one cannot hope to improve the condition of the joint until it is removed. If it can be brought well to one side, and fixed by a hat-pin, it can be removed through an incision made under the influence of a local anesthetic. This should not be attempted unless it is reasonably certain that only one such loose cartilage exists; *and the asepsis should be absolute.* The wound in the capsule should be sutured with fine plain catgut and the skin wound sutured with fine silk and a dry dressing and posterior splint applied. If any drain is employed, it should reach only to the incision in the capsule, and should be removed in two days.

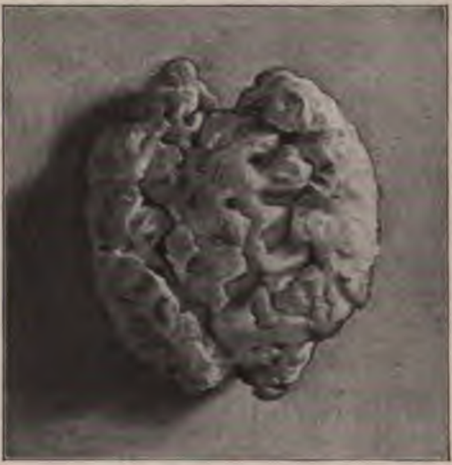

FIG. 261.—FLOATING CARTILAGE FROM THE KNEE-JOINT: THE "JOINT MOUSE" OF THE GERMANS. Removed through an incision made under cocain after the cartilage was speared with a hatpin. The illustration shows the cartilage enlarged 1½ diameters.

While in removing a floating cartilage it is necessary to cut directly down upon it, there is often a choice of location, since it can be moved about. The most favorable line of incision is that shown in Figure 262, or just anterior to the internal lateral ligament. At this point the capsule of the joint is covered only by the skin with its fat and a thin fascia. When the leg is extended this incision is parallel to its long axis.

These are the simplest cases. If more than one loose cartilage exists, or if displacement of one of the semilunar cartilages causes the symptoms, exploration of the knee-joint may be necessary, and a general anesthetic should be given. The exact site for the incision in case of semilunar displacement may sometimes be determined by palpation. A depression can sometimes be felt where the base of the semilunar has become loosened, and pressure at this point causes pain. Usually it is the anterior part of the inner semilunar which is affected. If it is not deformed or broken, it should be stitched in correct position by fine chromic gut. If this is not feasible, so much of the cartilage as is a hindrance to free motion of the joint should be removed.

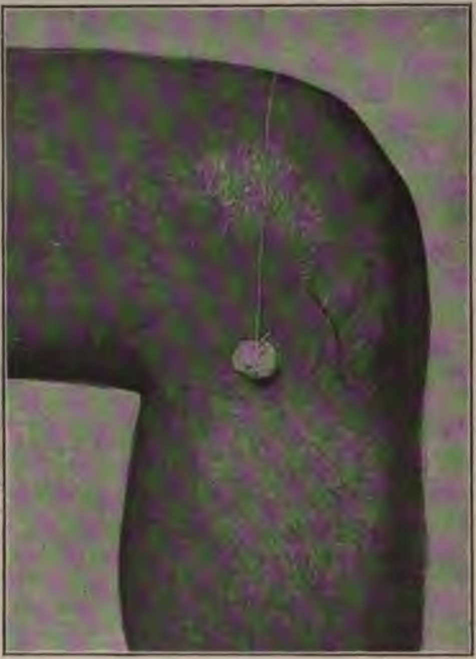

Fig. 262.—Incision for Removal of Floating Cartilage from the Knee Under Local Anesthesia. In the case shown the cartilage had been chipped from the tibia by traumatism, and although loose, was not in the knee-joint. Its approximate shape and location is shown by the wad of adhesive plaster, the upper edge of which is exactly in the horizontal plane of the knee-joint.

The incision for the removal of several floating cartilages from the knee-joint is a longitudinal one slightly longer than the one shown in Figure 262. A second incision, opening the outer side of the joint, is rarely necessary. The capsule of the joint should be sutured, not too tightly, with fine plain catgut, so that fluid can escape if it accumulates. A drain should lead to the wound in the capsule, but not through it, and the skin should be sutured with silk or horsehair. A splint should be employed; either a removable posterior one or a circular gypsum splint with a fenestrum to permit the removal of the drain in two days.

Sprains.—In injuries of this sort it is well to distinguish as far as possible between overstretching, or even rupture of the ligaments, and contusions of the soft parts, or even of the bones themselves (see p. 338).

Sprain of the Hip-joint.—The hip-joint is so well surrounded with strong muscles that it is rarely sprained. Contusions of the hip from falls on the side are common. In children a differential diagnosis must be made between sprain or contusion and tuberculosis of the joint; in adults beyond middle age, the usual differential diagnosis is between contusion and fracture (possibly impacted) of the neck of the femur. Age is not an absolute classifier of these three, so that all should be considered at any age.

METHODS OF EXAMINATION.—The patient should be stripped from the waist down and placed on a firm level surface. A folded towel laid between the thighs and brought up over the pubes to the umbilicus in no way interferes with a complete examination, and by lessening very much the feeling of exposure, aids the patient in relaxation. The hip should be inspected and palpated, and compared with the opposite side. Any change in color or outline, any thickening of the bones about the trochanter, any points of tenderness, and an abnormal position of either limb (abduction or rotation), should be carefully noted.

The two limbs should be measured from the anterior superior iliac spines to the internal or external malleoli. Before making these measurements, one should see that the two ilia are on a level, and that the feet and legs are equally distant from the median line of the body. A difference in length of less than one-half an inch has little diagnostic value. Fracture of the neck of the femur gives a shortening of an inch or an inch and one-half. In only a few cases is it more or less than these amounts. In sprain and the early stage of tuberculosis there is no shortening if the limb can be fully extended. If measurements reveal the existence of shortening, further measurements should be made to determine its exact location. This can be done in three ways: (1) The tibiæ can be measured; or (2) the distance from the tip of the great trochanter to the external malleolus; or (3) Bryant's perpendicular laid out. To do this accurately one should mark the upper limit of the great trochanter on the skin with ink; mark the anterior superior spine in the same way; and then draw a line on the skin directly backward (a vertical line as the patient is lying horizontally), and let fall a perpendicular from the trochanter to this line (Fig. 263). A difference in these two perpendiculars on the two sides will indicate a dislocation of the femur, a fracture of the neck, or an error of measurement. This method is far more accurate than Nelaton's, by

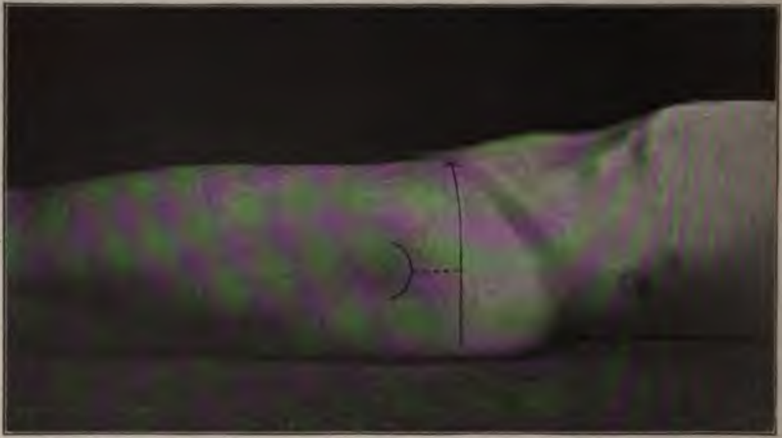

FIG. 263.—RELATIONS OF THE GREAT TROCHANTER TO THE ILIUM. BRYANT'S PERPENDICULAR IS THE BROKEN LINE.

which one estimates the possible displacement of the trochanter by drawing a line on the surface from the anterior superior spine to the ischium. Such a line is a curve, more markedly so in stout persons, and it is difficult to be sure that it follows the same course on the two sides of the body, even though its ends are accurately placed. By means of these various measurements one can in most cases say positively that shortening does or does not exist, and if present, estimate its amount and locate it exactly.

Occasionally a person is found whose legs differ in length by as much as an inch. If such a one sprains his hip on the short side, the diagnosis will be obscure for a few days until the prompt recovery rules out any serious injury. The author met one such case in a boy aged fourteen.

Finally, functions of the joint are to be tested. The various motions of which the joint is capable, adduction, abduction, flexion, extension, and external and internal rotation, are to be performed both passively and actively, and limitation of motion, pain, and muscular spasm are to be noted. Muscular spasm is most marked in tuberculosis, especially on overextension or external rotation. In fracture there is loss of active motion to a great degree, and the limb is usually fixed in external rotation, a deformity which cannot be overcome either actively or passively. Tuberculosis also gives a daily fever, at least of one or two degrees. Impacted fracture should always be recognized when present, by the abnormal rotation of the limb, its shortening, the marked loss of function, and the palpable thickening about the trochanter. A single examination may not serve in all cases to differentiate sprain and tuberculosis. The former will be cured by a few days' treatment of rest, secured by a light spica bandage of plaster of Paris; while the symptoms of the latter will only be somewhat improved by the bandage, even when combined with rest in bed, and will promptly return and grow worse as soon as the patient goes about again.

An unimpacted fracture of the neck of the femur, having the unmistakable symptoms of shortening, crepitus, and abnormal motion at the hip, can scarcely be confounded with the other lesions mentioned. In both impacted and unimpacted fractures of the neck of the femur there should be found displacement of the trochanter upward.

TREATMENT.—The treatment of sprain or contusion of the hip consists of rest in bed, with external heat or counter-irritants to control pain. The patient should be early encouraged to make the motions of flexion and rotation at the hip-joint while still in a recumbent position. As soon as tenderness subsides the normal use of the limb should be resumed. Such an injury is most apt to occur in the aged, and the early use of their joints is to be encouraged, in order to avoid stiffness. But first there should be a careful examination to exclude fracture, and second, the patient should be assisted in the early attempts to walk, lest a second fall add to the existing injury.

Sprain of the knee produces some or all of the following symptoms: Pain; tenderness, especially if extreme flexion or extension is attempted; partial loss of function; swelling of the soft tissues, and effusion of fluid into the joint cavity. If one of the lateral ligaments is torn there will also be an abnormal lateral motion in the joint when manipulated. The last named sign coming on suddenly after an injury is pathognomonic; but continued distention of the joint cavity will also stretch the ligaments of the joint, so that abnormal lateral motion is obtainable.

DEMONSTRATION OF FLUID IN THE JOINT.—Fluid in the knee-joint is best demonstrated by compressing the cul-de-sac beneath the quadriceps tendon with the palm of the hand, while one finger of the other hand pushes the patella lightly but quickly backward to the femur (Fig. 264). The leg should be extended on the thigh and the muscles relaxed during this test. If the joint contains no fluid, the patella is in contact with the femur, and nothing happens when it is thrust backward. If the joint contains even a little fluid, the position of the limb and the compression of the upper hand (left in the figure) forces the fluid into the lower and anterior part of the joint and the patella is separated from the femur. The sudden thrust of the finger pushes the patella backward through the fluid, and it strikes the femur with an appreciable click.

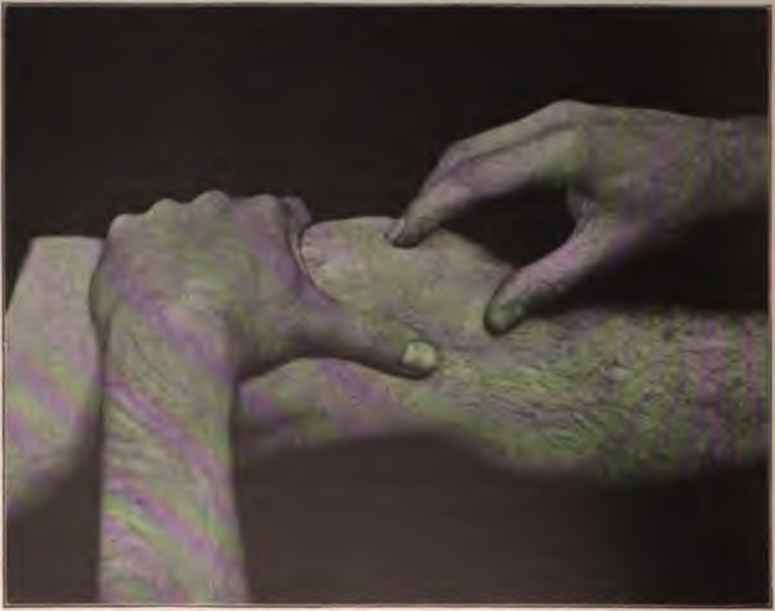

FIG. 264.—DEMONSTRATION OF FLOATING PATELLA.

The fluid in the knee-joint after a sprain is usually serous, though it may be bloody if the injury is more severe. Fluid is not pathognomonic of sprain, since it may be caused by internal sources of irritation, as is mentioned below, and in some cases no fluid can be demonstrated in the joint, even though a sprain is known to have occurred.

Differential Diagnosis.—In differential diagnosis with sprain of the knee-joint one must consider prepatellar bursitis, rupture of a lateral ligament, reduced dislocation of the knee, dislocation of a meniscus, loose or floating cartilage, and the various acute and chronic inflammatory disorders of joints to which the knee is especially subject, and sarcoma. For a full list of the symptoms of these various diseases the reader should look under the appropriate heads, as only the most striking differences are here given.

In prepatellar bursitis the fluid is confined in a comparatively small sac, which lies in front of the patella and not behind it, as in sprain, and the functions of the joint are not affected by it.

Rupture of a lateral ligament gives abnormal lateral mobility; reduced dislocation may be recognized by this same sign, or possibly only by the history.

A patient with displacement of a meniscus usually gives a history of repeated attacks of painful locking of the joint, followed by fluid in the joint and limitation of motion for a few days. Sometimes palpation will reveal an alteration in the joint about the base of the loosened meniscus.

A loose or floating cartilage will often have been detected by the patient, who may be able to demonstrate its presence by bringing it to one side of the joint. It keeps up the effusion in the joint to an extent not warranted by the history of injury, and indeed may exist without any pain or loss of function.

Acute suppuration in the knee-joint, following a punctured wound for example, on account of the great surface of the joint cavity produces much pain, swelling, fever, etc. It is a serious condition which cannot be confounded with slight injuries. A puncture of the knee-joint without suppuration does not prevent a patient from walking about. It should be recognized by the tenacious character of the escaping fluid, *not by the probe*. Such a wound should be cleansed and dressed at once, a posterior splint applied, and the patient put to bed, lest he suffer the much greater ills of a suppurating joint.

Acute rheumatism comes on without injury, gives a fever, and usually involves more than one joint.

Gonorrheal, gouty, tuberculous, and syphilitic arthritis are also slowly progressing affections with local and general symptoms of inflammation. If the inflammation is not marked and the disability of the knee is first noticed after some traumatism, a mistake in diagnosis is possible, but a careful history and examination will clearly separate these lesions from a sprain.

Arthritis deformans is a progressive affection which alters the ends of the bones, gives little or no fluid in the joints, and limits motions very greatly. It usually occurs independent of injury.

Sarcoma of the lower end of the femur is more likely to be mistaken for tuberculosis than for a traumatism of the joint. It always enlarges the bone, a point which can be demonstrated by the X-ray if not by the fingers.

Treatment.—The essentials of treatment of a sprain of the knee are rest to the joint and compression. These ends can be secured by a posterior splint and bandage. An excellent splint is made by wetting a plaster of Paris bandage and drawing it back and forth on a board fifteen or twenty times, a distance of two feet or more, according to the length of the patient's limb. It should reach from the ankle to the great trochanter. The layers of the bandage should be well rubbed together as they are applied to each other, so that the splint when completed shall be one solid piece. Three bandages, each three inches wide, are needed. The splint should be bandaged in position immediately, so that it may take the shape of the bare limb before it sets. If the limb is hairy, it should be smeared with vaseline or shaved. When the splint is hard it may be removed and covered with canton flannel, reapplied, and held in position by a soft bandage. A pure flannel bandage may be used for this purpose. If an inelastic bandage is used, the knee should be covered anteriorly with a broad pad of cotton, so that elastic pressure may be obtained. The splint should be broad enough to enclose fully one-third of the circumference of the limb, and the leg should not be absolutely extended on the thigh when the splint is applied, but should make with it an angle of about one hundred and sixty-five degrees. This gives the knee the greatest comfort when the patient is walking, sitting, or lying. Such is the initial treatment for a sprain of moderate degree. If the sprain is more severe, or if one of the lateral ligaments is ruptured, the patient should not be allowed to put any weight on the limb, and should lie in bed or go about on crutches.

A pleasanter method of treatment, applicable to slight sprains or more severe ones after the first or second week, is the strapping of the joint, laterally and anteriorly, with strips of adhesive plaster laid on diagonally (Fig. 265).

Still another method is daily massage and the application of an elastic bandage of flannel or rubber, without any splint.

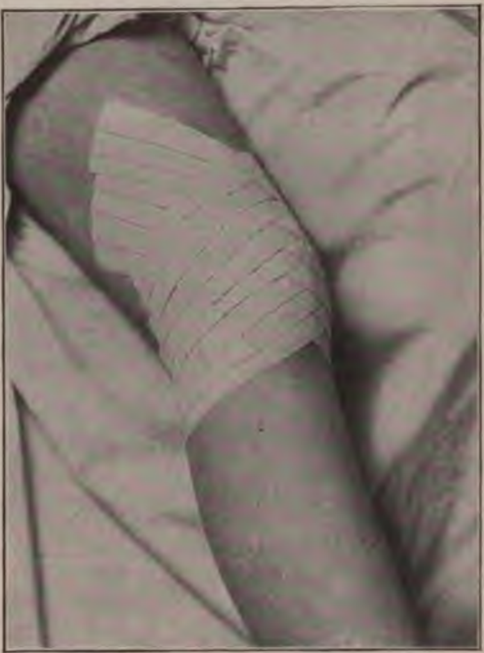

FIG. 265.—STRAPPING WITH ADHESIVE PLASTER FOR SPRAIN OF THE KNEE.

Sprain of the Ankle.—The ankle is more often sprained than any other joint of the lower extremity. For convenience, it is well to consider these sprains in three classes, according to the degree of the injury, whether slight, medium, or severe. In almost all cases the foot is turned inward, so that any tearing of the ligaments which occurs is usually on the outer aspect.

SPRAIN OF SLIGHT DEGREE.—In a slight sprain of the ankle there is a little pain and tenderness and a little swelling, especially below the external malleolus. The patient walks without difficulty, and there is no abnormal motion of the foot.

Treatment.—For the first and second day following the injury the limb should be kept in a horizontal position and treated by hot fomentations, light massage, and passive motions two or three times a day. On the third day and thereafter it should have a hot douche for thirty minutes, followed by a cold douche for a minute, and this followed by massage. This treatment should be repeated twice a day and active motion begun, the patient being allowed to walk.

Another plan is to apply adhesive strapping at once, as described below.

Sprain of Medium Severity.—If the sprain is of medium degree, the pain and tenderness are more marked, the swelling is greater and involves the whole circumference of the ankle, and there is more difficulty in walking. Some of the ligaments are ruptured, and in addition there is probably contusion of the articular surfaces of the bones.

The treatment described above for slight sprain may be carried out for forty-eight hours; or a flannel bandage may be firmly applied from the toes to the knee and the limb soaked in water at 110 to 115 degrees for three or four hours to prevent swelling.

After this preliminary treatment with hot water, or hot fomentations and massage, adhesive straps should be applied to the foot, ankle, and leg. They serve a threefold purpose, keeping the foot in a correct position, preventing extreme motion in any direction, and exerting automatic massage by varying the pressure in different parts every time the foot is moved.

The leg should be shaved, washed with soap and hot water, alcohol, and ether. Strips of adhesive plaster should be applied in such a manner that they will fit accurately and each will overlap the next by a third of an inch. The exact pattern makes little difference, since the individual strips are soon welded into a single casing. A good plan is to apply a broad strip like a stirrup, extending from below the knee on the inner side of the leg, covering the inner malleolus, the plantar surface of the heel, the outer malleolus, and finishing on the outer surface of the leg near the head of the fibula. In applying this, the foot should be held at a right angle to the leg, and in a correct position laterally, or possibly slightly abducted, in order to relax the strain on the injured ligaments. Additional strips not more than an inch wide should circle the heel horizontally, and reach to the base of the toes (Fig. 266). These should be carried well above the ankle. If there is fear that the swelling will increase, these horizontal strips may be stopped before they meet in front, although the support in that case will be less firm. A light gauze bandage completes the dressing. On the third day the patient can walk about with a cane, but the massage and passive motion should be continued.

If the adhesive plaster becomes loose, it should be removed and renewed. After two weeks it may be removed, but douches and massage should then be resumed and continued as long as the joint is weak.

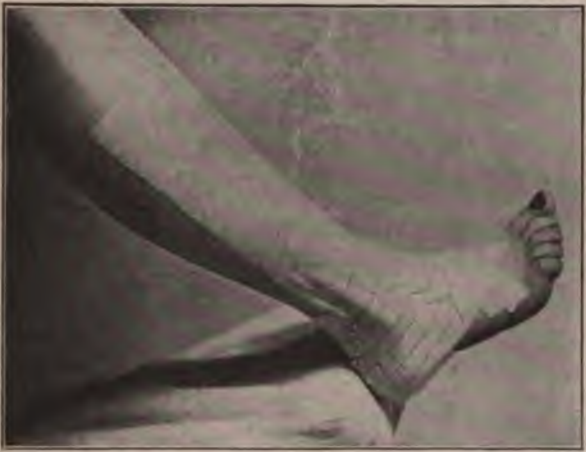

FIG. 266.—A GOOD METHOD OF STRAPPING A SPRAINED ANKLE WITH ADHESIVE PLASTER.

Some surgeons prefer cold to heat in the early treatment of these sprains, and keep an ice-bag in contact with the ankle for a part of each day after the adhesive plaster has been applied. This plan works well in some cases, but must be used with caution if the patient is old or feeble.

SPRAIN OF EXTREME SEVERITY.—In sprains of extreme degrees of severity there is marked pain and swelling, and a great deal of abnormal motion, amounting to a partial dislocation. One often suspects a fracture of one malleolus, although it may be impossible to prove this without a radiographic examination.

The plan of treatment is as follows: One should elevate the limb and apply hot fomentations to relieve the pain, and keep them hot with hot water bags, which can be changed from time to time without disturbing the wet cloths. The limb should be fixed by sandbags, not too tightly filled. Two or three times a day the dressing should be removed, and gentle massage given without disturbing the joint. A bed rest should keep the clothes from touching the foot. On the third, fourth, or fifth day, when the swelling has somewhat subsided, the leg should be shaved, covered with sheet wadding, and encased in a plaster of Paris bandage from the toes to the knee, the foot being held at a right angle. The patient may go about on crutches.

After two weeks the cast should be removed, a hot douche and massage should be given twice a day, and passive and active motion begun. The patient should bear his full weight on the injured foot in three or four weeks, according to the degree of injury.

Molded gypsum splints may also be used. (See Figs. 270 and 271, p. 506.) They are easily removed for massage and can be reapplied by the patient.

Recurrent Sprain of Ankle.—The ankle is especially liable to a resprain, and hence it is desirable in many instances to advise the patient to protect the joint long after the external evidences of injury have disappeared. Many persons prefer a woven rubber anklet, or one made of leather, which laces up, to the daily application of a bandage. Such apparatus is more serviceable at the ankle than at the knee, as the more limited range of motion at the ankle and the different shape of the parts make it easy to keep it in place.

Rupture of a Lateral Ligament of the Knee.—This injury is usually produced by direct violence. A heavy body, for instance, a falling sack of grain, strikes against the leg or knee, when the foot and body are fixed. The result is an undue stretching of the ligaments on the opposite side of the knee, with rupture. If this rupture is not too extensive, the patient can walk about, but he is careful to use the limb in such a manner as to prevent strain being brought on the ruptured ligament. Pain after this injury is slight if the limb is kept at rest. There is often very little ecchymosis, and the swelling may not be excessive. The pathognomonic symptom is an abnormal lateral motion, best shown as follows: Let the patient lie on his back, or lean back in a chair, with both legs at rest in a horizontal position. Test the lateral mobility of the sound knee by grasping the leg firmly above the ankle, and using the other hand as a fulcrum placed against the patient's knee. Test first the internal and then the external ligament. Repeat the tests on the injured side. If one of the ligaments is ruptured moderate force will swing the leg away from its normal line to an appreciable angle, perhaps twenty or thirty degrees. When the leg is relaxed it swings back into line with a peculiar snap, which is easily remembered if it has once been felt. It is something like the snap with which the lid of a match-box closes, if there is a spring in its hinge. Treatment is similar to that for severe sprain, plus a longer protection of the ligament by a posterior splint. The patient should remain in bed a few days, sit about or walk with crutches for ten days more, and wear a splint for another two weeks at least. Massage and passive motions are indicated after the first week or so.

Dislocations.—Dislocations of the larger joints of the lower extremity are rare and serious lesions, which are not seen in ambulant practise.

Dislocation of one of the toes sometimes occurs. In diagnosis and treatment it closely resembles dislocation of a finger, which see (p. 357).

Fracture of the Femur.—Most of the fractures of the femur are too serious to find a place in a text-book on minor surgery except in so far as they have to be considered in the differential diagnosis of sprains and contusions. It is, however, possible for a patient to fracture the femur and yet walk about. This is sometimes the case after impacted fracture, and walking is possible after fracture of the great trochanter.

Fracture of the Great Trochanter.—This rare injury is caused by a fall or blow directed against the great trochanter, a part of which may then be separated from the femur, remaining attached to the gluteal tendon.

The diagnosis is not difficult. There is a local pain, swelling, and ecchymosis. The patient walks guardedly, and gets up and sits down with pain and difficulty. Palpation reveals the loosened fragment, which may also be shown in a good radiograph (Fig. 267).

All the treatment that is necessary is to press the trochanter firmly against the shaft of the femur by a strip of adhesive plaster and to keep the patient in bed two or three weeks. The bone united firmly in the case of the patient referred to in Figure 267.

Fracture of Patella.—The patella may be broken by direct violence, as by a fall on the knee; or by indirect violence, when a sudden strain is brought upon the tendon of the quadriceps extensor. In the first case the fracture may be single or multiple, and the separation of the fragments slight or extreme, and there may or may not be rupture of the strong aponeuroses at the sides of the patella. These aponeuroses form so important a part of the extension apparatus that if they are not ruptured the patient may be able to extend his leg.

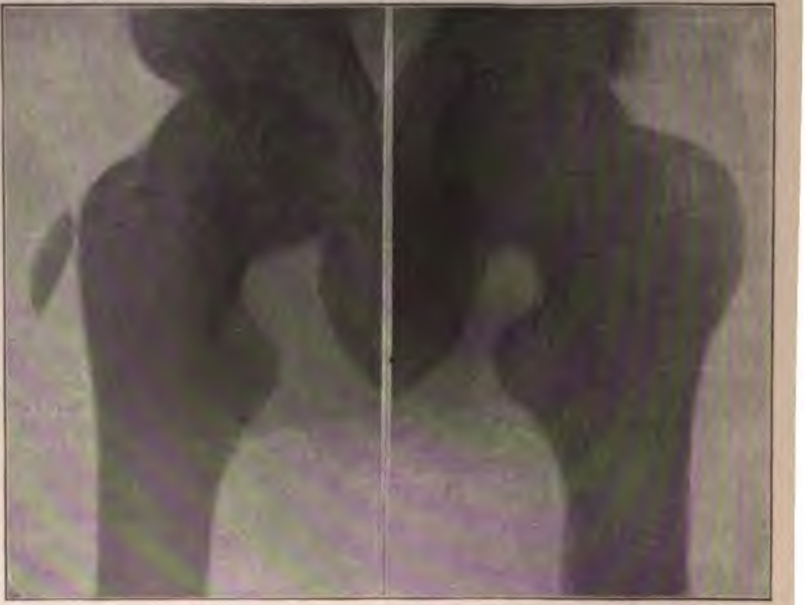

FIG. 267.—RADIOGRAPH OF A MALE PATIENT WHO FRACTURED HIS RIGHT GREAT TROCHANTER BY A FALL. The uninjured trochanter is shown for comparison.

If the fracture is due to indirect violence, it is almost always single and transverse, the lateral aponeuroses are apt to be torn, and the gap between the fragments is proportionately wide. Diagnosis is usually easily made by the history of the accident, by direct palpation of the fragments, by the presence of a gap which is lessened by pressure together of the fragments and increased when the leg is flexed, and by the inability of the patient to extend the flexed leg, although this can be readily performed by passive motion. Accompanying signs are swelling, ecchymosis (often absent), and fluid in the joint (either serum or blood). If the swelling is not great, crepitus may be obtained by crowding the fragments together, and moving one on the other.

TREATMENT.—The limb should be extended on a molded posterior splint for four weeks, more or less, during which time the fragments should be held in apposition in one of four ways: (*a*) by strips of adhesive plaster, or (*b*) by a suitably dimpled plaster of Paris circular bandage, or (*c*) by suture of the aponeuroses at the sides of and in front of the patella, or (*d*) by suture of the fragments themselves. If the fragments cannot be approximated digitally, neither (*a*) nor (*b*) is a suitable mode of treatment.

The posterior splint necessary, if plan (*a*), (*c*), or (*d*) is followed, is best made of plaster of Paris, according to directions on page 707. The leg should be fully extended when the splint is applied. When the splint has set, it should be removed, fully dried, and covered with canton flannel. It may be bandaged to the limb, or held in place with several pieces of broad tape or light webbing, brought together in front with buckles.

If plan (*a*) is followed, the limb is shaved about the knee, the fragments are digitally approximated, and fixed by two strips of adhesive plaster, one passing below the patella and anchored on the sides of the thigh, the other passing above the patella and anchored on the sides of the leg (Fig. 268). If these tilt the fragments a third strip may

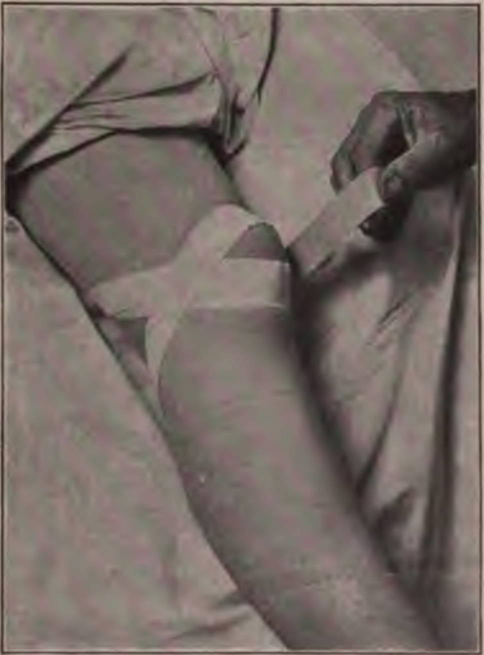

FIG. 268.—A DEMONSTRATION OF THE METHOD OF APPLYING STRIPS OF ADHESIVE PLASTER TO APPROXIMATE THE FRAGMENTS AFTER FRACTURE OF THE PATELLA.

be applied directly across the patella. The posterior splint should then be applied.

If plan (*b*) is followed, the fragments are approximated digitally by the surgeon, while the assistant applies a circular plaster of Paris bandage from above the ankle to the upper part of the thigh. The limb is kept in full extension by lifting it and placing the foot on a box some twelve inches above the level of the bed or table on which the patient is lying. Sheet wadding or some similar material is evenly spread over the whole limb. As the assistant carries the bandage across the knee, the surgeon carefully removes his fingers, one at a time, and quickly replaces them, thus keeping up pressure at the points at which he has found that he can best overcome displacement of the fragments. This procedure is repeated as often as the circular turns of the plaster bandage pass the knee. When the splint is completed there will be in it four or more depressions made by the finger-tips, and so disposed that they prevent the fragments of patella from becoming separated.

The accumulation of much fluid in the knee-joint will interfere with the successful employment of plans (*a*) and (*b*). The pressure of a rubber or other elastic bandage may cause its resorption in a few days. If not, it may be evacuated with a medium sized trocar and cannula, or better, through a quarter-inch incision. The risk of infection is extremely slight if the skin is washed with soap and water, turpentine, and alcohol, and the instrument is boiled and its point not handled. Local anesthesia suffices. The opening should be made at the side of the knee, and far enough back to be out of the way of the adhesive strips.

Treatment by Operation: Plans (*c*) *and* (*d*).—If digital approximation of the fragments is impossible on account of the presence of fascia between the fragments or for any other reason, ligamentous or bony suture should be advised—plans (*c*) and (*d*). Both of these entail the risk of sepsis, which in the knee may be serious; but in favorable cases the period of recovery is lessened and the union of the fragments is stronger than in many of the cases treated without operation. Therefore, operation is advisable even in many cases in which digital approximation can be achieved. A transverse incision of the skin, removal of blood clots from the joint cavity, and suture of the lateral aponeurotic tears and of the gap in the strong fascia anterior to the patella itself, with twenty day chromic catgut, is the simplest operation. But good results have been obtained by suture of the bony fragments, or by passing a string around the patella, or by other methods of approximation. The materials used have been wire and silk, as well as absorbable materials. The skin wound is to be sutured without drainage, and a posterior splint applied.

In the after treatment, massage is a valuable aid. It may be begun as early as the fourth day, care being exercised not to pull upon the fragments. Passive motions may be employed in two weeks, but they should be slight in extent until there is plainly union between the fragments. By these methods stiffness of the knee may be avoided. They cannot be employed if plan (*b*) is adopted, and hence the circular splint should be cut away in two weeks, and a new one applied, or a change in treatment may then be made to plan (*a*)—the use of adhesive strips.

A patient should walk with a shortened posterior splint in four weeks, but he should not attempt to bring strain upon the fractured patella, and such motions as kneeling or using that limb for stair climbing should be forbidden for three months.

Fracture of the Tibia.—Delayed Union.—Fracture of the tibia and fibula coexisting, and fracture of the tibia alone above the malleolus, are excluded from ambulant practise. Patients with such lesions may come for treatment some weeks after the injury, the bones not yet having united properly. It is therefore well to consider the treatment of non-union of the tibia. Palpation will reveal the plane of the fracture. The leg should be grasped firmly above the fracture with one hand, and below the fracture with the other. By a firm, quick motion, the broken bone should be tested for abnormal mobility. This test should be applied both laterally and anteroposteriorly. The position of the fragments, when at rest and when the patient bears weight on the injured limb, should also be noted. All of these facts should be recorded for future comparison. Radiographs should also be made in two planes.

TREATMENT.—The treatment will depend upon the conditions present. If the deformity is not extreme, or can be manually corrected, and if the fractured ends of the bone are in contact or can be brought into contact without producing too great deformity, union may be obtained by the following plan of treatment: Make two lateral molded plaster of Paris splints to reach from the ankle nearly to the knee. Each should be broad enough to cover about one-third of the circumference of the limb. This gives them a firmer grasp, and the curve adds greatly to their strength. When they have set they should be removed, dried, covered with canton flannel, and affixed to the leg with cloth straps and buckles. Every day, or every second day, the fractured ends of the bone should be ground together by the surgeon for two or three minutes or more, according to the temperament of the patient. This is not so painful a procedure as it sounds, and no anesthetic is required. The splints should be firmly strapped in place, and the patient encouraged to walk about with crutches, yet bearing much of his weight on the injured leg. This treatment should be repeated until there is tenderness and swelling at the site of fracture. The grinding of the bones together may then be performed less often, allowing time between treatments for the tenderness to subside somewhat, but not enough for all signs of irritation to disappear. In two or three weeks increased callus interferes with the grinding of the bones on each other, and this part of the treatment may then be omitted; but the patient should increase his exercise, and bear more weight on the limb. In many cases a complete bony union will result in one or two months.

If there is bad angular deformity which cannot be corrected manually, or if the ends of the tibia are plainly separated, and cannot be brought into contact except by producing an angular deformity, as is often the case after compound fracture with loss of bone (non-union after operation), the treatment above outlined is not indicated and operation must be considered.

It is also well to remember that a united fibula may keep apart the ends of a fractured tibia, especially if there is loss of the tibial substance. The author has seen two cases of failure after operation for non-union of the tibia, which were clearly due to this cause, as in both cases the condition was the same. There had been no resection of the fibula, and the cut ends of the tibia could not be approximated except by producing a bad angular deformity.

Fracture of the Fibula.—Fracture of the shaft of the fibula is usually the result of direct violence, but the bone may be broken near its upper extremity by a sudden pull of the biceps muscle. As the greater portion of the fibula is covered by thick muscles, fracture of its shaft may exist without the usual signs of swelling, ecchymosis, and crepitus. Palpation is unsatisfactory, and the patient may be able to walk. Hence it is no uncommon thing for a fracture of this character to be overlooked. Positive signs are shortening of the fibula, measured from end to end, pain on direct pressure, pain on pressure upon the bone at a distance from the point of fracture, and absolute inability of the patient to lift the heel from the floor while bearing weight on the injured limb. The reason of this is obvious. The heel is raised in part by the action of the flexor longus pollicis, and longus and brevis peronei muscles. These muscles arise from almost the whole length of the fibula, and their contraction disturbs the fragments of the broken bone. If the break is in the lower part of the shaft of the fibula, displacement of fragments, crepitus, and false motion can usually be made out in addition to the signs given above.

TREATMENT.—If the patient chooses to remain in bed, no apparatus is necessary other than small pillows or sandbags to steady the leg, and a cradle to keep the clothes from resting on the limb; but in most cases it is desirable to apply a light plaster of Paris bandage from the toes to the knee, with the foot at a right angle to the leg. The following day the patient may go about on crutches. During the first week, when sitting or lying, the foot should be kept at least as high as the hips in order to counteract the tendency to swell.

The immediate application of a circular bandage of plaster of Paris is often advised against on account of the risk of swelling in a constricted space. When the injury is a slight one, as in fracture of the fibula without severe contusion, this risk is slight. In all cases, however, the toes should be left uncovered for inspection. They should remain warm, and the circulation should remain active. The blood should return quickly to the surface when pressure made with the finger is removed. Such inspection should be repeated every few hours for a day or so, especially if the patient complains of a tight feeling or pain. In cases of doubt, it is better to cut the splint down the front. It need not be removed.

After the second day the patient may go about with crutches, and may begin to bear a little weight on the foot after the third week, increasing the pressure gradually, but not bearing full weight on the foot for at least four weeks. The splint may be discarded in two or three weeks after the fracture, according to the circumstances.

Fractures of the Tibia and Fibula (Either or Both), Involving the Ankle-joint.—These fractures are almost invariably due to indirect violence. They often follow slips and falls on the street. Many of them would be sprains except for the close mortising of the astragalus between the two malleoli. Many of these fractures are serious injuries, but others permit the patient to walk. It is necessary therefore to consider the whole class. The chief end of treatment after a fracture is to restore function by obtaining (1) bony union of the fragments in good position, and (2) mobility of the adjacent joints. In the treatment of fracture involving the ankle-joint, the second object has often been overlooked; and that is the more unfortunate, since non-union of a malleolus is very rare.

DIAGNOSIS.—Diagnosis in these cases should include not only the determination of a fracture and its approximate position, but also the change, if such exists, in the relation of the three bones forming the joint, namely the two malleoli and the astragalus. Upon the recognition and the correction of such displacement depends the restoration of the function of the limb. In most cases it is well to examine the patient under an anesthetic, and when possible to make radiographs of the ankle in both anteroposterior and lateral directions.

Displacement [illegible] cases, is usually lateral and backward. There is [illegible] swelling in these cases, a part of which is due [illegible] serum in the ankle-joint. [illegible] makes it impossible [illegible] is first seen a day or [illegible]

[illegible] is still advocated [illegible] side splints. [illegible] While good [illegible] the treatment [illegible] at once [illegible], if it is [illegible] more [illegible] splints.

differently padded, or to make new splints. If one has at command a good X-ray machine, the swelling of the soft parts will not prevent a correct diagnosis; but even without this help one can usually judge of the character of the displacement, and manipulate the parts accordingly. The best plan of treatment is then as follows:

Having determined the site of fracture and the degree of displacement, the surgeon should manipulate the foot until convinced that it is brought into a correct position. Sometimes it is only necessary to support the weight of the leg by a firm grasp of the toes, in order to prevent a recurrence of the deformity. A better plan in most cases is to grasp the heel between the thumb and two fingers, and while making traction with this hand in the long axis of the leg, to flex the ankle to a right angle by a firm grasp of the toes (Fig. 269); or one may correct lateral or posterior displacement by grasping the leg with one hand and the heel with the other. In both of these ways the foot can be flexed to a right angle with the leg, and slightly inverted. According to circumstances, the surgeon will hold the leg or entrust it to an assistant. If his assistant knows how to make and apply a plaster

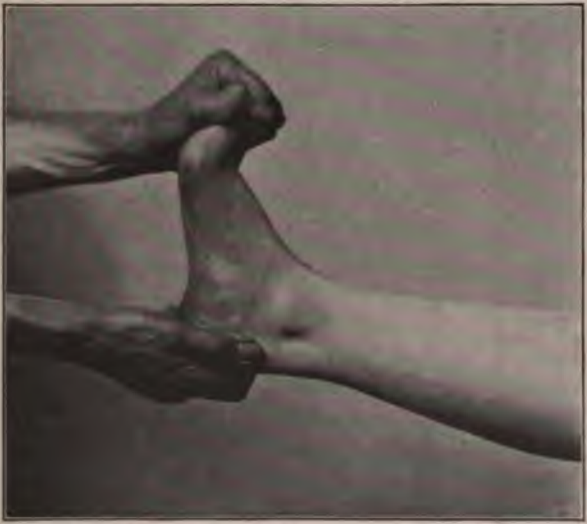

FIG. 269.—CORRECT METHOD OF HOLDING FOOT AND LEG, DURING THE APPLICATION OF A PLASTER OF PARIS SPLINT IN CASES OF FRACTURE OF ONE OR BOTH MALLEOLI.

of Paris splint, and can bandage it to the leg, the surgeon should hold the limb in a correct position, as this is the more important task. The making of strap splints is described on page 707. In this case two are required, each about twenty-four inches long, and three or four inches wide. Three roller bandages will make the two. The posterior is first applied, and should reach from the upper part of the calf to the tips of the toes. Next a lateral splint,

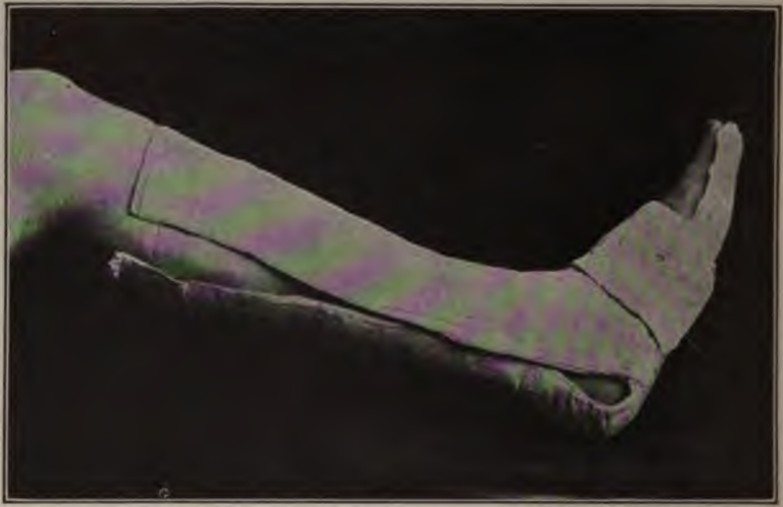

FIG. 270.—STRAP SPLINTS FOR FRACTURE OF THE MALLEOLI—IN POSITION.

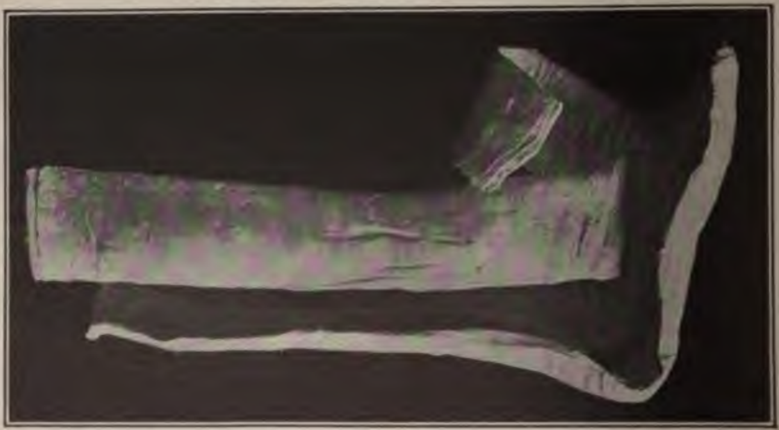

FIG. 271.—STRAP SPLINTS FOR FRACTURE OF THE MALLEOLI—REMOVED.

either internal or external, starting at the same level, is carried down the leg, across the middle of the sole, and then across the dorsum of the foot, until it reaches itself, after having encircled the foot (Fig. 270). These are bandaged in place with a gauze bandage. The person who is holding the foot in a correct position should not let go until the plaster has set—ten or fifteen minutes, if it is fresh. When dry the splints may be removed (Fig. 271), lined with canton flannel, and reapplied; but a safer plan is to leave them undisturbed for at least a week, as the lateral splint never gets quite such a firm grip again after it has been removed.

If one prefers a circular plaster of Paris splint for this class of injuries, its application is described on page 703. The correct holding of the foot and leg is equally important.

The object of flexing the foot to a right angle with the leg is twofold. This brings the wide portion of the astragalus between the malleoli, and thus insures a slot wide enough for free motion of the astragalus in walking. Secondly, if the ankle-joint should be stiff, the patient can stand with his heel on the floor, and therefore walk, not gracefully, but without pain. If the ankle is stiff in an extended position, equally good walking is impossible except by building up the heel of the shoe on the affected side, and the heel and sole of the other shoe.

The slight inversion of the foot is to prevent the formation of a traumatic flatfoot, which may result if the foot is everted. This inversion should not be excessive.

The patient may go about on crutches from the start in cases without displacement, and after a few days in the graver injuries. The injured foot should be kept elevated when the patient is sitting. After the first week the lateral splint at least should be removed for daily bathing and massage. This will add greatly to the comfort of the patient and hasten the recovery. The patient should bear some weight on the injured limb in four or six weeks, and the full weight in from six to eight weeks. There are numerous instances of recovery delayed beyond these periods, in which the functions were ultimately completely restored.

Fracture of the Astragalus.—The astragalus is broken by falls upon the feet, especially if the foot is sharply flexed against the anterior surface of the tibia. In such a case the fracture will probably extend through the neck of the astragalus, separating the head from the body. One-half the bone may then be dislocated from its normal position.

The symptoms complained of are pain when an attempt is made to move the foot or to bear any weight upon the heel. If there is no dislocation of a fragment, the diagnosis may be extremely difficult. It is desirable, therefore, to make radiographs of both feet for a careful comparison.

Treatment consists in reduction of the fragments. If there is marked displacement, reduction can seldom be effected without an operation. If the deformity is slight, the limb should be immobilized, with the foot at right angle to the leg and slightly inverted. A light plaster of Paris circular bandage from the base of the toes nearly to the knee accomplishes the objects of treatment admirably. In a few days this should be split down the front, removed for daily massage and passive motion, and reapplied.

Prognosis depends chiefly upon the amount of displacement. If this is slight, a normal gait may be regained in two or three months. If the displacement is considerable, the function of the ankle-joint is likely to be permanently impaired. If reduction cannot be accomplished by manipulation, the displaced fragment should be removed. It is worth remembering that good function has been obtained after the removal of even the whole astragalus.

Fracture of the Os Calcis.—The os calcis is broken by falls or jumps from high places, the patient striking squarely upon his heels. One or both bones may be broken. The plane of fracture may be either vertical or horizontal, or oblique, or irregular.

The chief symptoms complained of are pain and an inability to bear the weight on the heel. Examination will show a distinct increased bony thickness beneath the malleoli, as compared with the uninjured side. There is tenderness on pressure, and crepitus can often be obtained by grasping the malleoli with one hand and manipulating the base of the os calcis; or the anterior portion of the bone may be grasped with one hand and the posterior portion manipulated with the other. In some cases, when the acute swelling has subsided, the plantar surface of the heel is distinctly nearer the tips of the malleoli than on the uninjured side.

TREATMENT.—The foot should be placed in a correct position —that is, flexed to ninety degrees or less, and slightly inverted—

and held in this position by a light plaster of Paris bandage extending nearly to the knee. The patient should go about on crutches, without touching the affected limb to the floor. No other treatment is necessary. In two or three weeks the splint should be removed, and passive and active motion encouraged.

The pain after fracture of the os calcis varies greatly. Some patients suffer little, while others have some pain upon using the foot months after the injury.

If fragments of the os calcis are badly displaced, they should be removed, the prognosis after operation being favorable. The incision may be made on either side, low enough down to avoid injury to the vessels and nerves and tendons which pass under the malleoli.

Fracture of the Metatarsals.—Fracture of one or more of the metatarsal bones is almost always due to direct violence, such as the passage of a wheel over the foot or the fall of a weight upon it. The accompanying swelling, and possibly wounds of the soft parts, mask the fracture of the bone, but such a fracture can usually be made out by careful examination. The symptoms are swelling, ecchymosis, and pain. The pain is increased by pressure against the head of the affected metatarsal as well as by pressure directly upon the site of fracture. If the head of the bone is grasped and manipulated, pain is also increased, and often crepitus is produced. The patient can usually walk by bearing his weight upon his heel. A constricting bandage, either of adhesive strips or, better, of plaster of Paris, extending above the ankle, will give the patient considerable relief. Recovery is usually complete in one or two months.

Fracture of the Phalanges.—The bones of the toes are broken as the result of direct violence, and the fracture is often a compound one. The usual signs are present and are easily elicited.

Fracture of the great toe can be treated by splints. If one of the other toes is broken, it may be immobilized and deformity in it reduced by weaving rubber adhesive strips over and under the toes (Fig. 300, p. 555).

Amputations.—Most of the amputations of the lower extremity are major operations, and are followed by rest in bed, at least until the flaps have united; but as compound fractures of the toes are common in ambulant practise, a few words as to minor amputations will not be out of place. What has been said on amputation of the fingers (p. 390) is true for amputations of the toes. They should not be sacrificed for the sake of immediate appearance, although it is often well to lose a phalanx to gain primary union. However, a part of a toe has nothing like the value of a part of a finger. It is of the highest importance, however, to preserve the whole of the first and fifth metatarsal bones, because of their function in completing the arch of the foot and because of the muscular attachments to them. If the great toe is amputated, the tendon of the long flexor should be firmly sutured in the attachments of the short flexors to the metatarsal. If there is plenty of skin for the flaps the suture line should be kept away from the plantar surface of the toe by making a large plantar flap. In amputation through the metatarsophalangeal joint an oval incision may be chosen, or a long plantar flap may be sutured to a short dorsal flap.

CHAPTER XVIII

INFLAMMATIONS OF THE LEG AND FOOT

EFFECTS OF HEAT AND COLD

Frost-bite.—Slight exposures of the limbs of healthy persons to cold produce only temporary discomfort. Anemic and ill nourished individuals suffer from subsequent pain and burning of the exposed parts called chilblains. Prophylactic treatment consists in the administration of iron and other tonics, in the wearing of warm loose clothing, in the improvement of local circulation by cold bathing, etc.

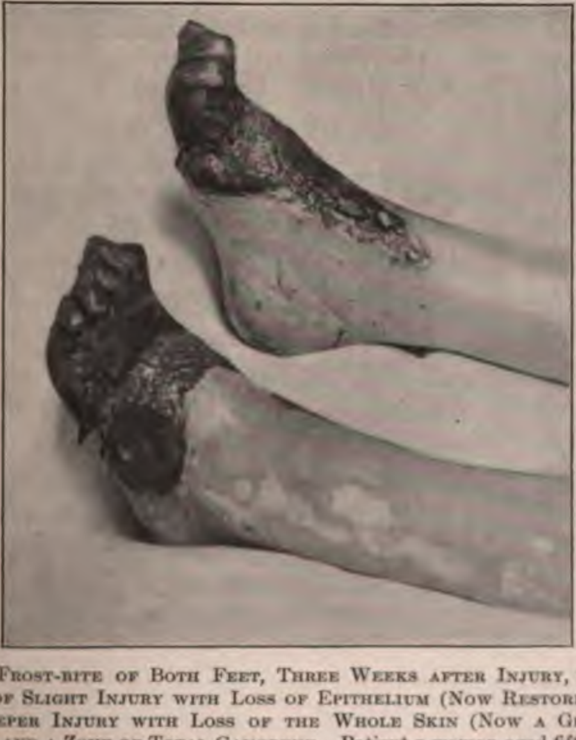

Fig. 272.—Frost-bite of Both Feet, Three Weeks after Injury, Showing a Zone of Slight Injury with Loss of Epithelium (Now Restored), a Zone of Deeper Injury with Loss of the Whole Skin (Now a Granulating Area), and a Zone of Total Gangrene. Patient a woman aged fifty-six years.

When any part of the body has been chilled or frozen its temperature should be very gradually raised to normal. The more severe the frost, the greater the importance of this rule. Hence it is generally understood that a limb which is frozen solid should be thawed out by rubbing with ice or snow, or by immersion in ice-water. Even in less severe cases the person should keep away from the fire on entering the house, and should bathe the affected part with cold water. Painful spots may be painted with tincture of iodine.

The importance of conservative treatment in the severer degrees of frost-bite has been emphasized on page 397. The accompanying illustrations (Fig. 272 and Fig. 273) show most graphically how much may be gained by delay. The new growth of epithelium and granulations made it possible to amputate less tissue and still gain union of the flaps. All of the tarsal bones were preserved in the right foot, while in the left foot it was necessary to remove the cuneiforms. The patient notices a distinct difference in the stability of the two feet on this account. At the time of the amputation even these flaps were not entirely

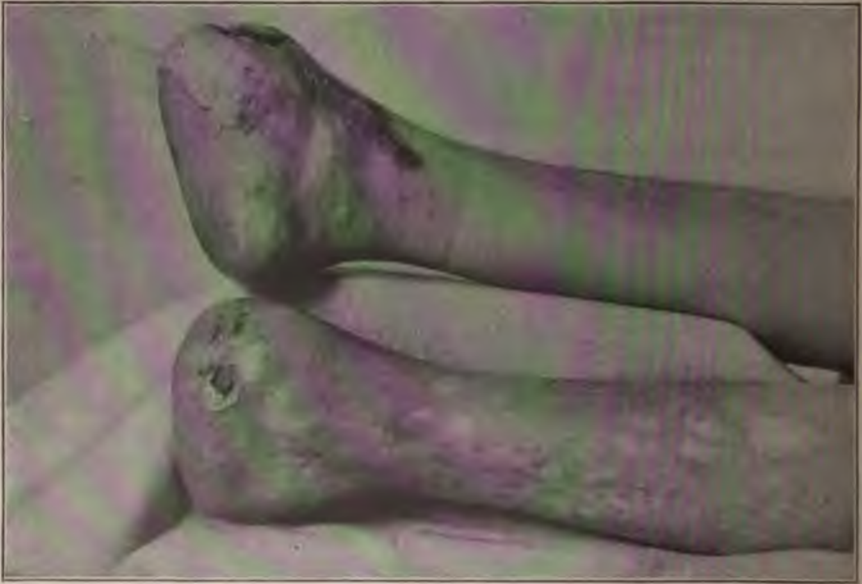

FIG. 273.—FROST-BITE OF BOTH FEET SHOWING THE RESULTS AFTER DELAYED AMPUTATION. The patient (same subject as Fig. 272) walks easily without a cane.

covered with epithelium. The deeper tissues united promptly, but the granulating areas required many weeks to become covered by epithelium, in part derived from skin-grafts, and in part from lateral growth from the existing epithelium. This is, however, time well spent, since the useful feet obtained are far superior to the stumps remaining after a Syme's or even a Chopart's amputation. Compare what is said below, in the paragraphs on gangrene.

Burns.—The dorsum of the foot is often burned by hot water, etc., spilled upon it. More serious burns of the lower extremity are due to the skirts catching fire. The burns in such cases are most severe on the posterior surface from the knee to the hip (Fig. 274).

Directions for the treatment of burns are given on page 26.

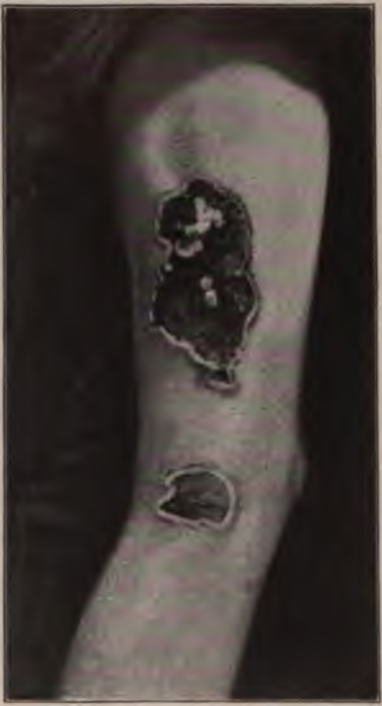

FIG. 274.—BURNS OF THE BACK OF THE LEG AND THIGH OF A CHILD CAUSED BY CLOTHING CATCHING FIRE. Photograph four weeks after injury. Note that a few deep groups of epithelial cells have escaped injury, and have grown up so as to form islands in the granulating area.

Gangrene.—For clinical purposes cases of gangrene of the toes or foot should be divided into two classes: In one class the cause is external—a crush, a burn, carbolic acid, frost-bite, etc., and is usually not repeated. In the other class the cause is internal—endarteritis, diabetes, Raynaud's disease, etc. In this class the cause is more or less continuous. In the first class palliative treatment should be carried out until the line of demarcation is well established. The superficial gangrene in these cases is almost always more extensive than the deeper gangrene, so that by delay good flaps may be obtained for a lesser amputation than at first appeared possible (Fig. 275).

The reverse is often true in gangrene due to a constitutional disorder. Then one has to do with a condition which tends to progress. Hence amputation should not be too long delayed, and when performed, it should be at a sufficiently high level not only to insure union of the flaps, but to render improbable a recurrence of the gangrene within a short time.

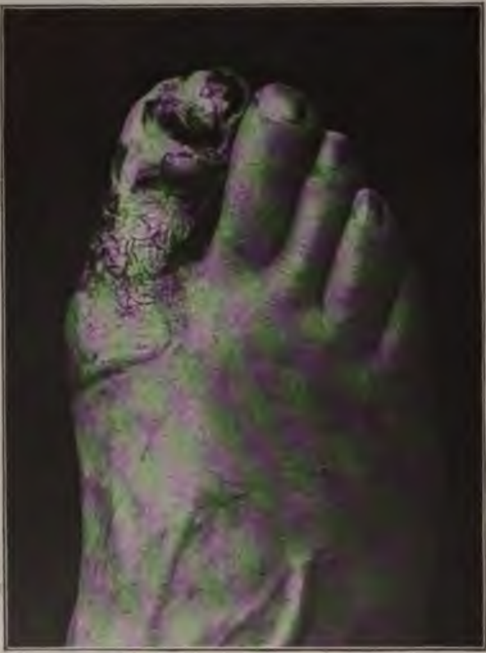

FIG. 275.—GANGRENE OF TOE, POSSIBLY FROM FROST-BITE; NO DIABETES. Duration one month. Patient a man aged fifty-two years.

The early manifestation of gangrene from an internal cause is a venous congestion, sometimes accompanied with blisters extending part way from the toes to the ankle, and usually a little higher on the inner than the outer side of the foot. In this early stage of the trouble hot and cold bathing, rubbing, elevation of the foot from time to time during the day, and most important of all, a dry dressing of cotton to prevent loss of heat, will generally postpone the gangrene for a considerable time, perhaps for months or even years, if the general state of health can be improved. The skin under such circumstances is easily destroyed. One should avoid the use of counter-irritants, as intractable ulcers may easily be produced by them.

ACUTE INFLAMMATIONS

While in the upper extremity the hand is especially exposed to injury, the foot is protected by the shoe, so that contusions and wounds of the lower extremity are oftenest met with in the shin, and, owing to poor circulation, lesions at first slight may become serious. Thus a small cut or scratch may develop into an annoying ulcer in individuals whose general health is good, while in those in whom there coexists chronic systemic trouble or eczema, edema, or varicose veins, destructive inflammations are even more common. These differences result chiefly from the poorer circulation in the dependent extremity; partly from the fact that the parts injured in the two extremities do not usually correspond. Thus it is the hand which is most often injured in the upper extremity, and the leg in the lower. Infected wounds of the forearm behave more nearly as do those of the leg in forming local cellulitis and abscess. These remarks apply only to acute infections. Syphilis and tuberculosis have their own methods of tissue destruction, so that the lesions of such diseases vary little whether in the arm or leg.

Cellulitis.—Cellulitis in the lower extremity is apt to be accompanied by an unusual amount of edema on account of the poorer circulation in this part of the body. The same may have existed before the injury or it may be wholly due to the infection, a point which can be settled by comparing the two limbs. To overcome the edema the patient should lie down most of the time, or sit with the affected limb in a horizontal position. A wet dressing is cooling and assists in overcoming the infection. It is better not to prevent evaporation by rubber tissue, but to keep the gauze wet by pouring water on it every hour or so. For the further treatment of cellulitis see page 35. Abscess should be watched for, and opened early. A large hypodermic needle is a most satisfactory means of making an early diagnosis of abscess.

Lymphangitis.—A superficial lymphangitis with reddened vessels traceable as far as the glands in the groin, and corresponding to that which so often occurs in the upper extremity, is seldom seen. A deeper lymphangitis, following the veins, and often associated with phlebitis and thrombosis, is of more frequent occurrence. It is a serious malady, and by extension upward into the vena cava, or by embolism, or simply by the intensity of the septic process it may cost the patient his life. In view of this fact every patient who has a deep lymphangitis of the leg should be treated in bed from the time the diagnosis is made.

Phlebitis and Thrombosis.—Phlebitis or inflammation of a vein may develop in a varicose vein (p. 538), and run the course of an acute inflammation without suppuration, or it may be accompanied by suppuration, though no visible source of infection be present. The first symptoms of phlebitis are pain, heat, redness, and swelling over an area an inch broad and which is more or less long, according to the extent of the inflamed vein. The vein itself can usually be felt as a tender indurated cord in the center of this area. If thrombosis takes place in the vein, the hardness of the vessel is more marked, and persists after the tenderness and surrounding swelling have subsided.

The phlebitis may gradually subside without extending further, but it usually extends upward either in continuity or skipping a few inches of the vein the process will repeat itself further up. Thus a patch of phlebitis in the calf of the leg may be followed by another in the thigh, the intervening veins remaining normal. Usually, however, it spreads by continuity.

TREATMENT.—In the first days phlebitis should be treated by rest in bed and an ice-bag. When the acute pain has subsided, unguentum ichthyol and a firm bandage make a good dressing. The limb should be bathed and moved with caution, even after the acute symptoms have passed over. Massage is contraindicated. One does not wish to break up a thrombus and send its fragments into the blood-current.

If the patch of phlebitis is small, a patient may absolutely refuse to go to bed. His leg should then be treated with unguentum ichthyol and a firm bandage, and he should keep as quiet as possible. The danger in such a case is that the thrombus may extend upward, or that a portion being detached may form a fatal embolus. Still embolism is a very rare accident in thrombosis of the veins of the leg or thigh.

Suppuration may occur at any time in the history of a thrombus, even without any visible break in the skin. If an abscess forms, it should be opened. If it is of a sluggish character a short incision will suffice.

Resection of the affected vein has been advocated recently as a means of quicker recovery (ten days to two weeks) in non-suppurative cases. This is a heroic remedy for a disease which is often very mild; but it is especially suited to cases in which the varicose veins require removal irrespective of the acute inflammation.

Lymphadenitis.—The femoral or inguinal glands may become inflamed from an infected wound of the leg or foot. Search will usually reveal the entrance of the infection. If the wound is treated properly, the swelling of the lymph-glands usually subsides. If the glands suppurate, the pus must be evacuated. Removal of the affected gland should be performed when possible, as the healing afterward is more prompt than when the gland is merely incised. (Compare p. 431.) The incision for either operation should be strictly longitudinal to avoid injury of the nerves and vessels of the groin. The removal of a lymph-gland is always a more difficult procedure than the previous examination of the parts would indicate. The gland is so readily palpable that one is apt to forget that the very fact that it elevates the skin also indicates that the under surface of the gland is deeply embedded in the tissues. Hence the patient should be given a general anesthetic before any attempt is made to remove the gland, especially if it is inflamed.

Abscess.—Superficial abscess in the thigh or leg may follow a contused or lacerated wound, or it may develop from a small scratch or from the bite of an insect (Fig. 276). It is usually associated with much edema and cellulitis, so that the presence of pus is not always easy to make out. In doubtful cases, if there is considerable

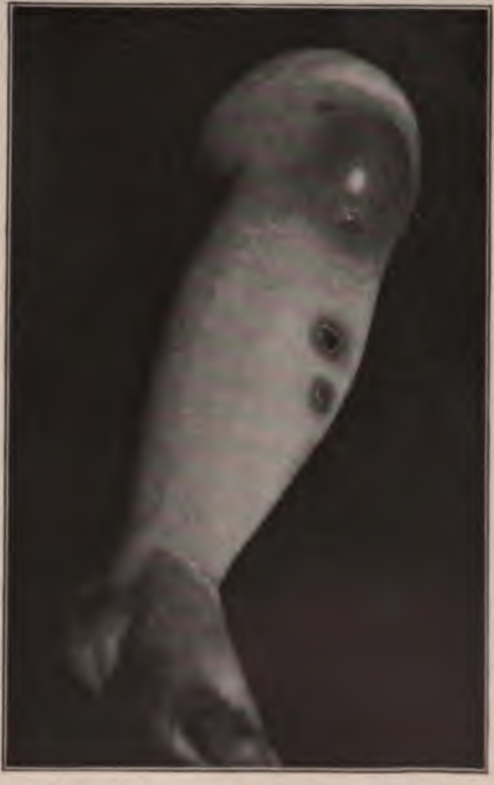

Fig. 276.—Abscess in Front of the Knee from an Infection on the Shin. Patient a girl, one year old.

pain, and particularly if the process is extending in spite of a wet dressing and rest to the limb, an incision should be made. A quantity of serum will escape and relieve the tension, even if no pus is found. If phlebitis can be ruled out cellulitis in the leg will generally be found to have a purulent center. (See p. 515.)

Suppuration about the knee in the form of small boils may keep up for a long time, reinfection taking place in a most provoking manner.

Abscess in the foot may arise from a punctured wound made by a wire nail or sliver and from injudicious paring of a corn or callus. If the vicinity of such a wound is swollen and tender it should be incised and drained. (Compare punctured wound of finger, p. 331.) If the punctured wound is in the ball of the foot, the pus often collects dorsally and should then be evacuated by a dorsal **incision**, either with or without a plantar incision through the original wound. It is not necessary to connect these two incisions; each can be treated from its own surface of the foot.

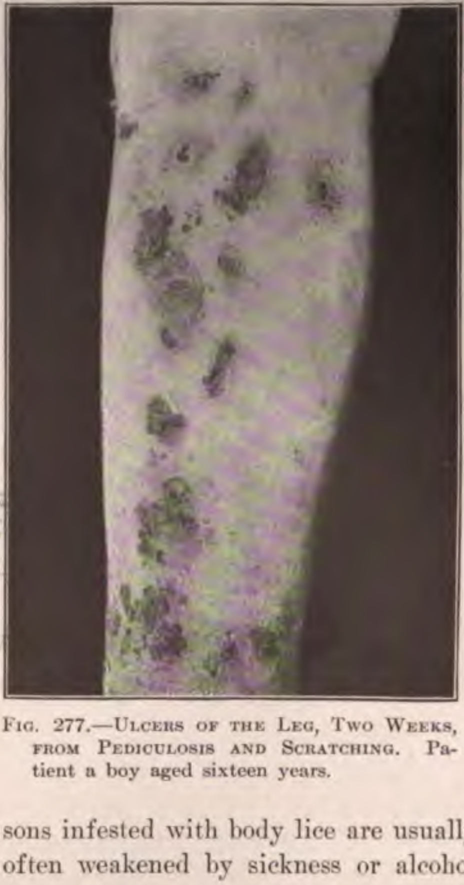

FIG. 277.—ULCERS OF THE LEG, TWO WEEKS, FROM PEDICULOSIS AND SCRATCHING. Patient a boy aged sixteen years.

Infected Insect-bites—Vagabond's Disease.—The bites of the body louse, insignificant in themselves, cause an intense itching, to relieve which the patient scratches the skin violently, making deep abrasions. In a healthy person with a clean skin infection would not be likely to result; but the persons infested with body lice are usually impoverished individuals, often weakened by sickness or alcoholism, or lack of food, and unable to bathe frequently. Hence the scratches often ulcerate—especially those made upon the back and legs (Fig. 277). The appearances are so uniform that the condition is often spoken of as Vagabond's Disease.

TREATMENT consists in the removal and disinfection of the clothing by boiling or otherwise, bathing the patient, and the use of some antipruritic lotion or salve to control the itching, which often lasts long after the insects have ceased to bite. Shallow ulcers generally heal promptly; the deeper ones should be treated according to principles laid down in the following pages.

Eczema.—Eczema of the leg is of interest to the surgeon because it so frequently precedes and accompanies chronic ulcer. It is usually of the dry papular form, but a weeping eczema is occasionally seen in connection with ulcer of the leg, forming a combination of lesions which tries the skill of the doctor severely. The eczema causes itching, the itching causes scratching, the scratching causes ulceration, the ulceration causes discharge which irritates the skin and increases the eczema. Such conditions, if neglected in ill nourished individuals, may easily lead to chronic ulceration.

The treatment of eczema is given on page 57. Its treatment, when combined with ulcer of the leg, is given on page 524.

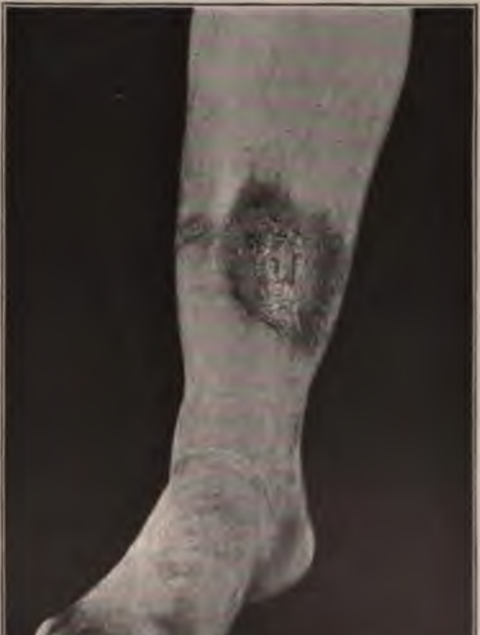

FIG. 278.—ULCER OF THE LEG OCCURRING IN A MAN AGED FORTY YEARS.

Chronic Ulcer of the Leg.—Both on account of its frequent occurrence among working people, and still more because of its duration, chronic ulcer is by far the commonest lesion seen in a surgical dispensary (Fig. 278). Some ulcers can be cured in a few weeks, in other cases months of the most faithful treatment must elapse before the epithelium can be coaxed over the granulating area. In these difficult cases a single ill chosen dressing, or a failure of the patient to come for treatment for a few days, or an alcoholic debauch, may wipe out the gain of weeks. In dealing with a problem of this character it is evident that a change of doctors, or carelessness on the part of the patient, must materially interfere with the success of treatment. Hence there are instances of patients who have come to be treated for an ulcer of the leg, more or less continuously for many years. Probably most of these patients could be cured if they could be regularly treated by the same surgeon for a period of six or eight months (Fig. 279).

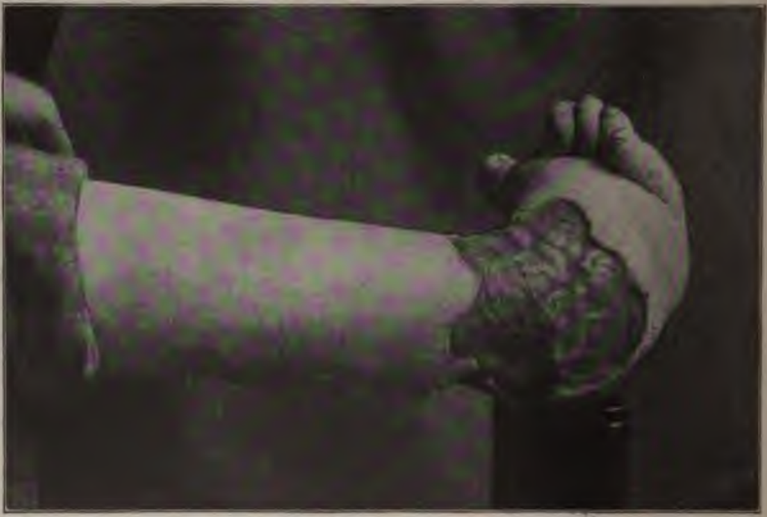

FIG. 279.—CHRONIC ULCER ALMOST SURROUNDING LEG.

It is at least the opinion of the writer after dressing hundreds of these ulcers for weeks together that they can all be healed by local ambulant treatment if they are due solely to local causes. There are a few ulcers due to constitutional causes in which local treatment has no effect, but these are rare exceptions.

PREDISPOSING CAUSES.—The constitutional disorders predisposing to chronic ulcer of the leg are alcoholism, anemia, diabetes, syphilis, and any trouble such as cardiac or nephritic disease, which causes chronic edema, and any disease of the nervous system which affects the nutrition of the skin. Endarteritis, diabetes, and some nervous affections produce degenerative processes in the toes and feet rather than ulcers of the leg.

The local conditions which favor chronic ulcer of the leg are eczema, edema, dermatitis, and varicose veins.

Eczema is a prominent factor in many cases, and of secondary importance in others. It causes the patient to rub and scratch the leg and thus form new ulcers.

Edema may be soft and easily compressible, disappearing at night when the patient lies down, and reappearing after he has been for some hours on his feet. It may also be of a chronic type, almost as hard as a board, seriously interfering with the local circulation.

Dermatitis is usually seen only in the early stages of an ulcer, or after neglect, or very bad treatment.

Varicose veins are often spoken of as though they were the sole cause of a chronic ulcer. Hence the name "varicose ulcer." This is an erroneous idea, as varicose veins are only one factor in chronic ulcer; and a chronic ulcer which depends chiefly on varicose veins for its existence is one of the easiest kind to heal, because the dilatation of the veins can be so readily counteracted by a well fitting bandage. The term "varicose ulcer," as applied indiscriminately to chronic ulcer of the leg is therefore misleading and should be given up.

Etiology.—The immediate cause of an ulcer of the leg is usually a traumatism, such as a blow on the shin or a scratch of the finger-nails. Occasionally the traumatism may be so slight that the patient cannot explain the beginning of the ulceration; or the start may be in the spontaneous rupture of a dilated vein. Wrong applications or infection of the scratch spread the necrosis of the skin and an ulcer is started, which in a few days may destroy skin that can be restored only by careful treatment of several weeks' duration (Fig. 280). It may fairly be called a chronic ulcer therefore, even from the beginning.

Treatment.—It is obvious that an ulcer which is largely due to unfavorable circulatory conditions is more easily handled if the patient can lie up in bed. This should be the first advice to those who can afford to follow it. Unfortunately most patients cannot afford the time for this; so that the problem before the surgeon is, in most cases, how to repair the leg while the patient is walking about all day, or worse yet, is standing at a wash-tub or bench. Let him console himself with the thought that an ulcer healed under these conditions will be likely to remain healed with reasonable care, while one healed in bed may easily break down when the patient goes about, unless the patient is especially careful to guard against the change in circulation when he leaves the bed. This is one reason why ulcers closed by skin grafts are so apt to break down again.

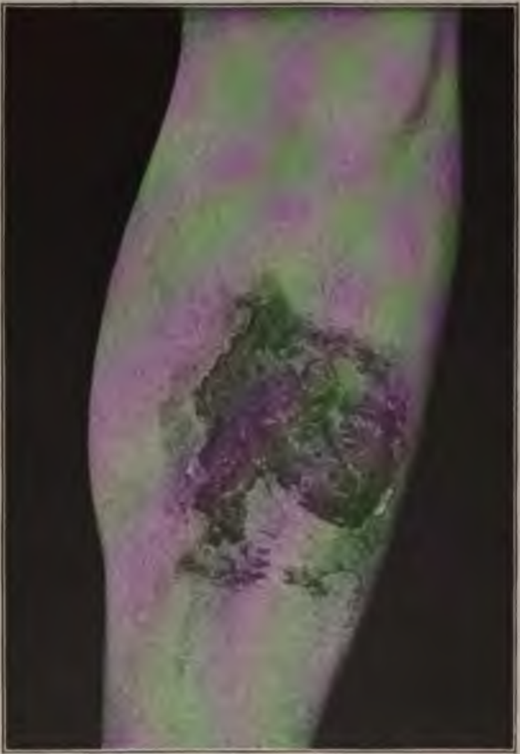

FIG. 280.—ULCER OF LEG TWO WEEKS FROM SCRATCH; SPREAD BY VASELINE DRESSING. Patient a man aged thirty-three years.

Since so many factors may contribute to keep a chronic ulcer of the leg from healing, it is plain that the treatment must be different not only for different patients, but also for any given patient, according to the appearance of the ulcer. When a single remedy is advocated as a sure cure for all ulcers, it is evident that the experience of its advocate is limited, or else his observation is careless. The measures here given are intended to combat one or more of the conditions which retard recovery. They should be combined in a way to meet the symptoms which exist. When one measure has been used for a week or so with good effect, and then its influence wanes, continued improvement may follow a change to another agent of the same class.

1. *Measures to Overcome Anemia and Chronic Edema.*—A daily hot bath of the foot and leg for twenty minutes will stimulate circulation, and in a few days soften and reduce an old hard edema. Besides it cleanses the surrounding skin, lessens the itching, and thus reduces the tendency of the patient to scratch the leg. Rubbing the leg with a cotton swab saturated with crude petroleum will remove discharges and crusts, will soften the skin and reduce edema, will alleviate itching, and will not increase any existing eczema.

2. *Measures to Cleanse the Ulcer.*—The ulcerating surface may be wiped with a cotton swab soaked with any mild antiseptic solution. If hydrogen peroxid is used, it should be diluted with four or eight parts of water. Many ulcers are extremely tender when treatment is first begun, and strong peroxid causes sharp burning pain. If there is a tendency to eczema one should be extremely careful to avoid the application of irritating solutions even for cleansing. A swab soaked in crude petroleum is a good thing to cleanse such skin.

3. *Measures to Allay Acute Inflammation.*—If the skin and subcutaneous tissues about the ulcer are inflamed, it is a good plan to soak the foot and leg daily for twenty minutes or more in a pail of hot carbolic solution (1 : 120), and to apply compresses wet with carbolic acid in 1 : 100 solution, or creolin in 1 : 200 solution, or corrosive sublimate 1 : 2,000 solution, or aluminum acetate in 1 : 25 solution. The limb should be bandaged with a gauze bandage, and the dressing kept constantly moist by cold water poured on the outside of the bandage every hour or two. No gutta-percha or other impervious material should be wrapped about the leg. An outside piece of flannel may be used to keep up the warmth if the leg feels cold. This dressing is more suitable for warm weather than for cold, unless the patient is confined to his bed.

4. *Measures to Stimulate Granulations.*—Eight or twelve thicknesses of gauze, cut so as to overlap the ulcer on all sides by a half-inch, and saturated with red wash, may be kept moist by additions of water, or by the application over it of a large compress thickly spread with Lassar's paste or any thick salve non-irritating to the surrounding skin. This will keep the astringent gauze moist for two days, and does not sweat the underlying skin,

as does rubber tissue. Other solutions, such as creolin, 1:200, or nitrate of silver, 1:100 or 1:200, may be used to saturate the inner gauze.

Another plan is to apply to the ulcer gauze saturated with balsam of Peru, pure or mixed with oil. This balsam gauze requires no protective covering, as it does not quickly dry out.

The granulations are even more powerfully stimulated by dusting the ulcer thickly with granular naphthalin before applying the wet gauze. This powder is antiseptic and does not cake.

5. *Measures to Promote the Growth of Epithelium.*—Epithelium will grow rapidly in moisture and warmth, provided there is freedom from irritating discharges, a good circulation, and granulations which are as nearly as possible on a level with the skin. The measures already described in paragraphs 1, 2, 3, and 4 are calculated to assist therefore in promoting the growth of epithelium. Exuberant granulations are rarely seen in chronic ulcers of the leg. If they occur they should be burned lightly by touching them in spots with a pencil of silver nitrate, which should in no case be applied within one-fourth of an inch of the skin margin, since the caustic action spreads somewhat beyond the area touched. Under the most favorable conditions epithelium can hardly be made to grow in the leg at a faster rate than one-eighth of an inch a week. This would give a month as the shortest possible time for the healing of an ulcer of the leg one inch across, provided the ulcer involves the whole thickness of the skin, so that no islands of epithelium may grow up in the center of the ulcer.

Occasionally it happens that granulations grow up in little tufts and become covered with epithelium (Fig. 281). This gives a pebbly appearance to the scar which can still be seen even after the epithelium has become of normal thickness. Such an ulcer is usually very painful until entirely healed.

6. *Measures to Overcome Itching and Eczema.*—Mild dry eczema is sufficiently treated by the measures mentioned under paragraphs 3 and 4. For excessive itching nothing is better than sponging with a solution of carbolic acid, 1:20. If the eczema is the chief feature, it may be treated by cleansing with crude petroleum, dusting freely with lycopodium, and covering with compresses soaked in crude petroleum; or compresses soaked with aluminum acetate solution, 1:25, may be applied and kept con-

stantly wet with water; or other measures suitable to the treatment of eczema elsewhere in the body may be employed.

Eczema occuring at the junction of the skin of the sole and that of the dorsum of the foot leads to ulceration that is very slow

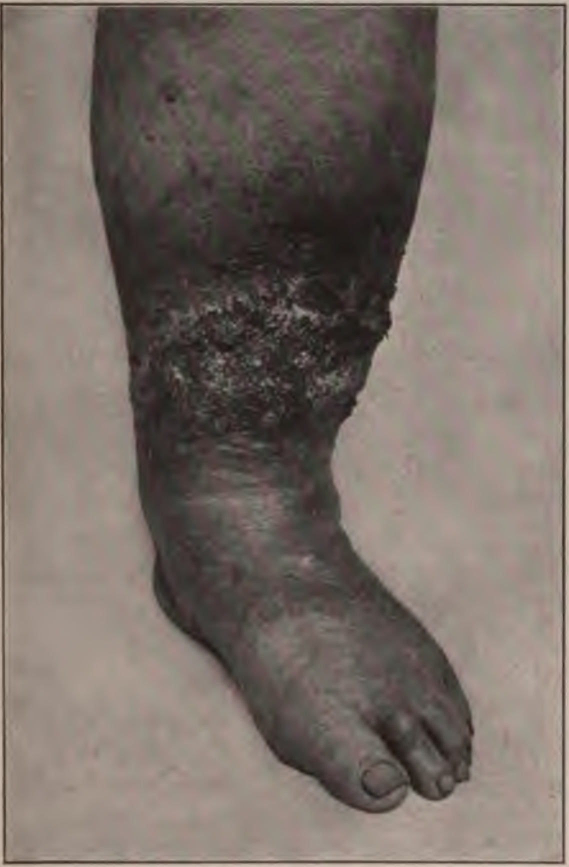

FIG. 281.—CHRONIC ULCER OF LEG WITH PROLIFERATION, GIVING IT A PEBBLY APPEARANCE EVEN WHEN HEALED. Patient a woman aged sixty-three years.

to heal. Therefore one should be very exact with the early treatment. Compare perforating ulcer, page 529.

7. *Measures to Reduce Venous Engorgement and Edema.*—In all cases in which edema or venous engorgement is present, whether or not large varicose veins are prominent, elastic bandaging is of great importance. While the ulcer is still open, a rubber bandage or stocking is not permissible. Elastic compression

may be applied outside of the dressing selected, by means of an even layer of non-absorbent cotton and a cotton bandage or by a flannel bandage or a stockinet bandage. In any case the bandage should begin at the base of the toes and extend above the calf, omitting the heel unless the ulcer is situated below a malleolus. The successful application of a bandage of this sort requires considerable practise. The test of a good bandage is not in the pattern made by its turns, but in the smoothness with which they lie one over the other, felt by passing the hand down the back of the leg after the bandage is complete. If all the turns press evenly the bandage will remain in place, even though the patient is constantly walking about, and when removed there will be no ridges in the edematous leg to indicate where one edge of the bandage was drawn tighter than the other. The best type of bandage to apply is shown in Figure 396, page 674.

8. *General Measures to be Observed During the Healing of an Ulcer.*—Any habit of the patient or constitutional condition that exerts an unfavorable influence on nutrition and repair should be corrected if possible. The patient is better without much alcohol, tobacco, or tea. Constipation often needs to be corrected. Circular garters have been severely criticized, but probably have little effect in producing varicose veins. If possible, the patient should rest for an hour or two a day in a horizontal position. At least he can make a practise of putting the affected leg upon another chair whenever he sits down. If there is good reason to believe that an ulcer is syphilitic (Fig. 282), mercury and iodid of potash should be administered. It is a mistake, however, to infer that every chronic ulcer occurring in a patient who has had syphilis at some period of his life is syphilitic.

9. *Measures to Prevent the Recurrence of an Ulcer.*—A large proportion of the chronic ulcers seen in a surgical clinic are recurrent. They have been healed once or many times, have remained so for weeks or months, and usually on account of the neglect of the patient, the skin in or near the site of the old ulcer has broken down, and a minute ulcer forms. Sometimes the patient has the good sense to come immediately for treatment; usually he treats it at home with lard or vaseline, or worst of all carbolic salve, and the ulcer rapidly increases in size and is an inch or more in diameter when first seen by the surgeon.

This sad relapse can usually be avoided if the patient will, firstly, bathe the healed leg daily or at least twice a week with soap and water, dry it, and rub it thoroughly with crude petroleum or any bland ointment, wiping away the excess of grease; and, secondly, will wear an elastic stocking or bandage *every day of his life*. If an elastic rubber stocking is chosen, it should extend from the base of the toes to the knee, omitting the heel. Such a stocking costs from $2 to $8, according to the material (cotton, linen, or silk) and the manufacturer. Under it should be worn a thin white cotton stocking. This protects the leg from the rubber, and the rubber from the perspiration. An ordinary stocking is worn outside of the elastic one. With care such a stocking will last six months.

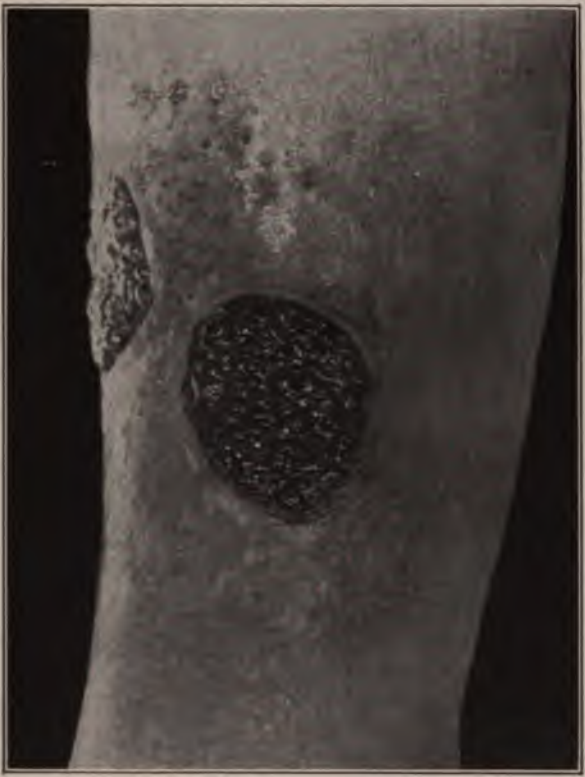

FIG. 282.—ULCERS OF LEG DUE TO SYPHILIS.

Another plan is to bandage the leg with flannel. Two yards of coarse white flannel (every thread wool) are either torn or, better, cut on the bias, into strips 2½ inches wide. These strips are sewed together, end to end, so as to make two roller bandages, each about eight yards long. Before the patient leaves the bed in the morning one of these bandages is to be applied from the toe to the knee, omitting the heel, and worn till bedtime. One of the two bandages should be washed every week. This method is cheaper and cleaner than the other, and gives in the hand of a person of ordinary dexterity a more even compression of the leg than the rubber stocking, the latter being at first too tight, and soon stretching so as to become too loose. It is, however, a little more trouble to apply a bandage than a stocking.

10. *Operative Treatment.*—Chronic ulcer of the leg may be treated by skin-grafting, but the results are not always good, either because the base of the ulcer does not attach the graft to itself, or because it affords such poor nourishment that a part or the whole of the graft breaks down within a few weeks. Before attempting skin-grafting the circulation in the vicinity of the ulcer should be improved by bathing the leg with hot water and giving it a good rub once or twice daily. Even after a thorough preparation of this sort, the base of an old ulcer may have very little vitality. It may even be infiltrated with lime salts to such an extent as to lead one to suppose that the tibia is exposed; but the signs of a bone ulcer—viz., periosteal swelling, sinus formation, and the loosening and casting off of necrotic bone—will of course be wanting. If there is such a calcified base to the ulcer, it should be dissected out and the skin applied to the base of the wound, or the skin-grafting postponed until new granulations have formed. The details of skin-grafting are given on page 577. The leg of an unhealthy or aged person is a most unfavorable site for skin-grafting, so one should be guarded in prognosis. Sometimes the grafts will not attach themselves, sometimes they atrophy from lack of nutrition while the patient is still in bed, and sometimes they ulcerate from the same cause or from traumatism after the patient gets up. Even after such a graft has firmly attached itself, the patient should spend a good deal of time in a horizontal position until the new skin grows strong. It should also be protected against slight traumatisms, such as the rubbing of the clothing against it.

Ulcer Exposing Bone.—The tibia may be exposed in case of a traumatic ulcer (Fig. 283), but even if the periosteum is carried away by the injury, the underlying bone need not necessarily die.

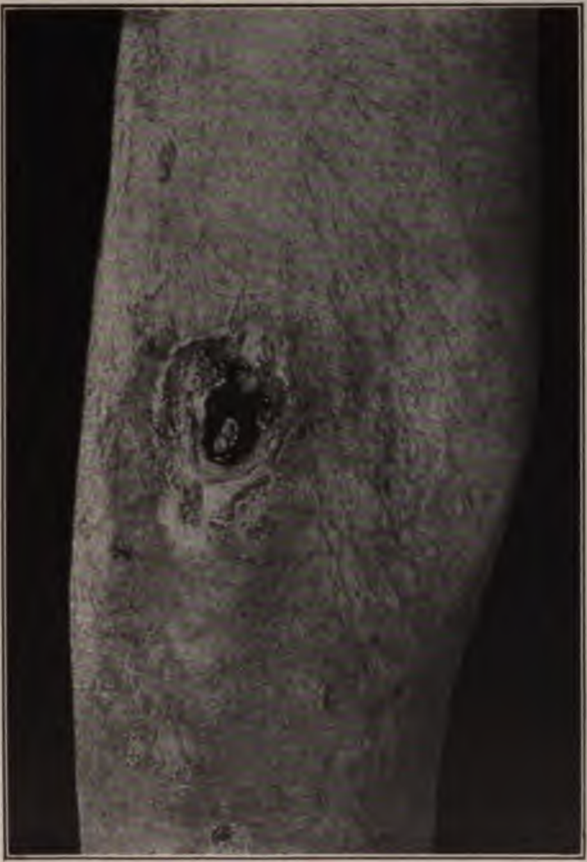

FIG. 283.—TRAUMATIC ULCER OF LEG EXPOSING THE TIBIA, ONE WEEK AFTER INJURY. The white spot in the center of the ulcer is the bare bone, not dead however. Patient a man aged twenty-two years.

It may send out granulations from its interstices, which shall form a soil for the growth of epithelium until the ulcer is quite healed.

Perforating Ulcer.—Callosities on the first or second or third toe, or on the ball of the foot, often give pain and are pared away with a knife or scissors. In this manner infection may occur and lead to an abscess. If the pus strips up the callosity from the deepest layer of epithelium, and then either breaks through the superficial skin or is evacuated, it may cure the patient of his callosity. Instead of this happy result, one usually finds that the callus has been only partly separated from the deeper skin, and that beneath it is a small deep ulcer; hence the name perforating ulcer (Fig. 284). Such an ulcer, bounded as it is by tough, thick, slowly growing skin and occurring usually in those past middle age, is extremely difficult to heal. The surrounding edge of the skin should be pared away, or removed with a salve containing ten per cent of salicylic acid. Every effort should be made to keep the parts soft and pliable at the same time that the treatment of the ulcer itself is carried out in accordance with the principles given in the preceding pages. Plastic operations aiming to cure the ulcer by skin-grafts, or by flaps, are usually unsuccessful. If neglected, the perforation may extend and cause the loss of one or more toes (Figs. 285 and 286). The urine of these patients should always be carefully examined, as many of them have either nephritis or diabetes.

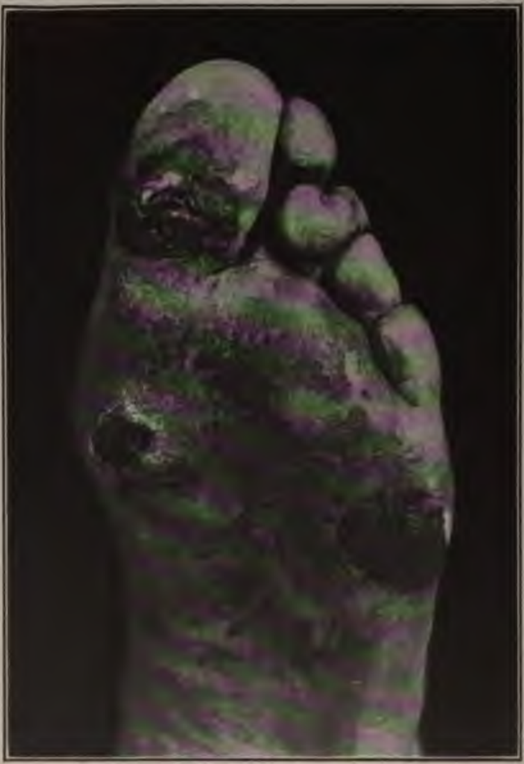

FIG. 284.—PERFORATING ULCERS OF FOOT, DURATION SIX MONTHS. Patient a man aged thirty-eight years.

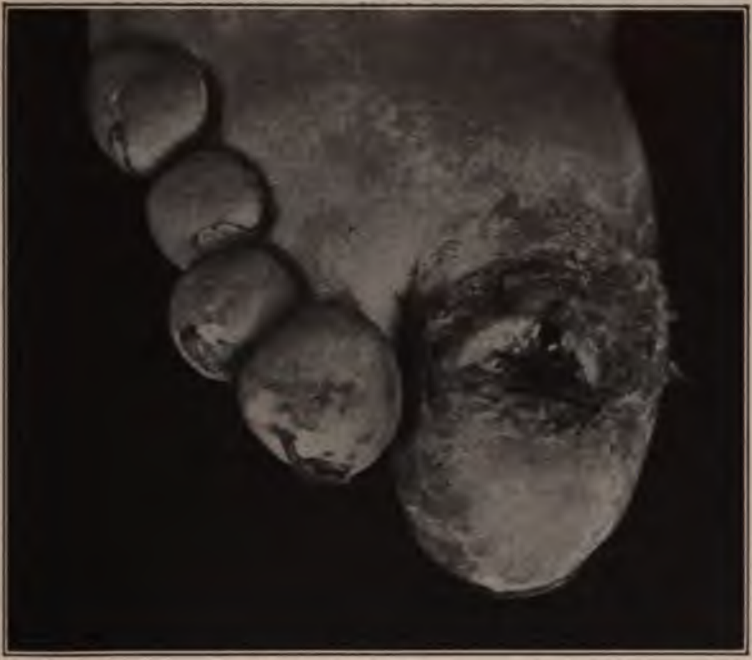

FIG. 285.—PERFORATING ULCERS OF TOES, TWO YEARS. Patient a man aged fifty years.

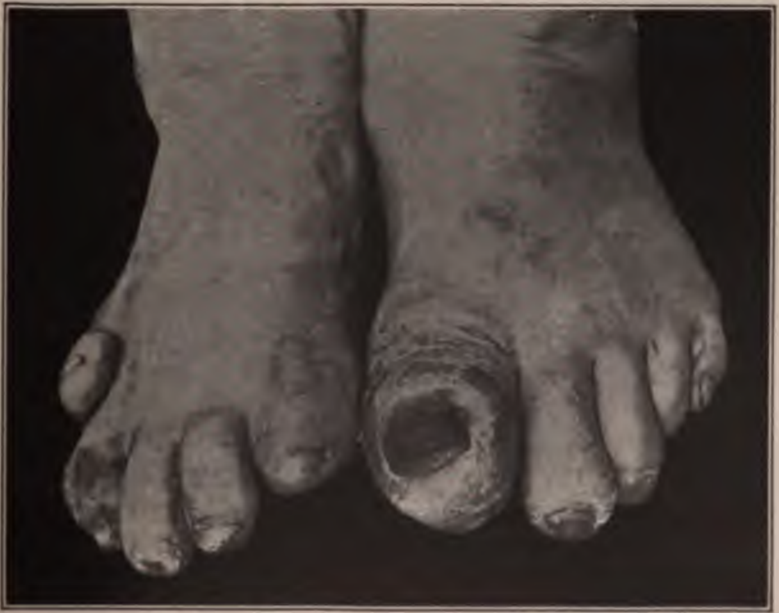

FIG. 286.—DORSAL VIEW OF SAME FOOT AS SHOWN IN FIG. 285, AND ALSO OF THE RIGHT FOOT, ONE OF THE TOES OF WHICH WAS LOST AS A RESULT OF SIMILAR ULCERATION.

ARTHRITIC AND CHRONIC INFLAMMATIONS

Suppurative Synovitis.—Suppuration in the knee-joint or other joint of the lower extremity may follow a compound fracture or a punctured or incised wound, or a carelessly performed aspiration for serous synovitis. It may also develop from the blood in acute infectious diseases, or in gonorrheal arthritis. In the last named disease the fluid in the joint may be seropurulent or purulent, from a mixture of gonococci and pyogenic organisms; finally, suppuration in the bone (osteomyelitis), or in the soft parts (boil or abscess), may break into the joint.

The signs of suppurative synovitis are the same as those of serous synovitis (p. 483), plus increased pain and tenderness, and edema and redness of the periarthritic soft tissues, so that fluctuation in the joint may be masked by these added signs.

TREATMENT.—The course of the disease in mild cases may be toward spontaneous recovery; but unless both general and local symptoms steadily improve, the surgeon should not rest content with the milder forms of treatment suited to serous synovitis, but should aspirate to prove the presence of pus, and then drain. Such a joint soon suffers permanent injury. The cartilages erode, and the bones may necrose before nature gives relief by the establishment of fistulæ to the surface.

In case of wounds which may involve the joint, an incision should be at once made, at least to the capsule. If the capsule is not visibly injured, or if there is a probability from the character of the injury that the joint cavity is not infected, drains should be placed so as to reach the capsule, but not enter it. If the joint has been visibly opened, or if there is probability of its infection, it should be freely incised and irrigated with saline, and drained with rubber tissue. A wet dressing should be applied and the limb elevated, and kept at rest by a splint. (See also p. 425 for the later treatment of an inflamed joint in order to increase its mobility.

Some of the special forms of inflammation involving the lesser joints of the lower extremity, or the larger joints to a lesser degree, require further mention.

The joints of the foot in diabetic, nephritic, and otherwise debilitated individuals often become the seat of a chronic suppuration developing from trivial causes. Thus the first metatarsophalangeal joint (less often the others) may suppurate as a result of infection of a corn or callus on the sole or side of the foot. While this lesion is analogous to suppurative arthritis of the hand (p. 423), it is far more difficult to get rid of, even with the patient in bed, both because of the poorer circulation of blood in the foot and because it generally occurs in persons of middle age or older, who are not entirely healthy. Diabetes, gout, endarteritis, and chronic nephritis should always be borne in mind and differential diagnostic tests made. If any one of these diseases is found to exist, and acute symptoms do not promptly subside when a lateral incision has been made into the joint, resection of the joint or amputation of the toe above the joint or of the foot is advisable; for even if incision and drainage give temporary relief, a sinus will probably persist, with a slow necrosis of the end of the bones making up the joint.

Rheumatism.—In acute rheumatism the inflammation rarely goes on to suppuration, but recovery is favored and pain relieved by rest to the affected joints secured by a splint or rest in bed. Guaiacol, twenty drops on cotton covered with rubber tissue, is a good local application. The salicylates should be given internally, ten grains more or less every four hours. It is well worth remembering that in some cases acute rheumatism is confined to a single joint. This proportion is given by some writers as high as twenty per cent.

Gonorrheal Arthritis.—The knee is frequently a seat of gonorrheal inflammation, being attacked about as often as the wrist. While gonorrheal arthritis is usually monarticular, it occurs in more than one joint in perhaps twenty-five per cent of the cases in which the joints become involved at all. The affection develops rather slowly, but gives in the course of a few days in a striking manner the cardinal symptoms of pain, heat, redness, swelling, and loss of function. A history of gonorrhea within a few weeks past can usually be obtained, and a drop or two of pus can usually be expressed from the meatus of the male patient. If the diagnosis is still doubtful, fluid may be withdrawn from the joint, for microscopic examination. This should be done with the strictest aseptic precautions. Tuberculosis is common in the knee, but develops more slowly. Gout and syphilis are more prone to attack the smaller joints of the foot, and each has its own history.

a long time, and is especially painful at night, and may leave some permanent thickening of the bone. The usual form of gumma with ulceration may also occur.

Another late manifestation of syphilis in the lower extremity is the involvement of a joint or joints. Either the periarticular tissues may be the seat of the gummata or the bones themselves. According to the degree of severity there may be fluid in the joint, or general swelling with plastic adhesions, or erosion of cartilages, ankylosis, and contraction of the muscles.

TREATMENT.—The usual antisyphilitic treatment should be employed (p. 61). In addition there should be rest to the affected parts, during the acute stage, and massage and passive and active motions to restore the use of the joints after the acute symptoms have passed over. For this purpose a rocking-chair and teeter are very serviceable. Treatment suitable for the ulcers is described on page 521.

Tuberculosis.—In making an early·diagnosis of joint tuberculosis, one should not be misled by the history of a fall or a slight sprain. This injury may be the beginning of the tuberculous lesion, or it may simply have served to call the attention of the patient to a joint already involved by tuberculosis. The existence of swelling in the joint, of slight atrophy of the muscles above and below the joint, of tenderness of one of the bones of the joint, and of muscular spasm when the joint is moved to the limit in various directions, ought to convince the examiner that he is dealing with something more serious than a sprain. If he is still in doubt he should keep the part at rest and examine it again in a few days. If there is only a sprain, the symptoms will have disappeared for the most part. If there is tuberculosis, the symptoms will be essentially the same, though the tenderness and swelling usually subside somewhat under the influence of rest. There will also be a slight afternoon fever. The X-ray may show the affected bone to be less dense in places, and perhaps a little larger than normal.

TREATMENT.—If the patient is a child, whether the tuberculosis is in the hip, knee, or ankle, a suitable brace should be provided to keep the inflamed joint quiet, and to take from it the weight of the body. If the patient is an adult the case is somewhat different. He will usually prefer crutches to a brace, and because his chance of successfully overcoming the disease is not as great

TREATMENT.—Wet dressings and a posterior splint, and as much rest to the limb in a longitudinal position as the patient can afford, should be the principles of treatment. Baking is excellent to relieve pain and reduce swelling. Later, counter-irritants and strapping (p. 493) are good measures with massage, when the acute inflammation has entirely subsided. It may be several months before all of the symptoms due to gonorrheal inflammation of the knee disappear, but the functions of the joint are seldom permanently impaired. The effusion into the joint may be so great that aspiration, or even incision and drainage, are advisable to preserve the vitality of the tissues.

Gout.—This disease produces such well known gastric, nephritic, cutaneous and nervous symptoms that its local lesions are not often mistaken for anything else. The treatment is usually not surgical, but if the urates accumulate in a position to incommode the patient, they should be removed. Such is not infrequently the case with deposits in the feet. There is a wide-spread hesitation to perform any surgical operation upon a gouty patient, but a small dissection requiring only local anesthesia produces no noticeable shock, and is followed by just as prompt healing as when performed upon the non-gouty. If the urates ulcerate through the skin, the opening should be enlarged, and the foreign matter removed. If a joint suppurates, it should be drained, or if necessary resected.

It is only in the exceptional case that operative treatment is required. For the most part the local treatment consists in hot applications and rest to the affected joint, while the general treatment includes the use of colchicin, diuretics, laxatives, and anodynes, according to circumstances.

Syphilis.—The various lesions of syphilis later than the primary lesion are regularly found in the lower extremity. Of the deeper lesions, gumma of the skin and subcutaneous fat may produce a sluggish ulceration, with indurated margin and possibly overhanging edges; while at a later stage of the lesion, when the induration has disappeared and the cavity has partially filled with granulations, the appearance differs little from that of any healing ulcer.

Syphilitic periostitis of the tibia is common. It does not usually lead to ulceration, but forms a diffuse swelling which lasts a long time, and is especially painful at night, and may leave some permanent thickening of the bone. The usual form of gumma with ulceration may also occur.

Another late manifestation of syphilis in the lower extremity is the involvement of a joint or joints. Either the periarticular tissues may be the seat of the gummata or the bones themselves. According to the degree of severity there may be fluid in the joint, or general swelling with plastic adhesions, or erosion of cartilages, ankylosis, and contraction of the muscles.

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TREATMENT.—If the patient is a child, whether the tuberculosis is in the hip, knee, or ankle, a suitable brace should be provided to keep the inflamed joint quiet, and to take from it the weight of the body. If the patient is an adult the case is somewhat different. He will usually prefer crutches to a brace, and because his chance of successfully overcoming the disease is not as great as it is in childhood, the question of operative removal of the affected tissues by resection or amputation ought to receive early consideration.

The treatment which has proved so beneficial to many patients having pulmonary tuberculosis is equally desirable for those suffering from tuberculosis of the bones and joints. The essentials of this treatment are a constant supply of fresh air, a large supply of food, especially of fats, and a rapid carrying off of the waste products by the free use of cathartics. One or two spoonfuls of the juice which can be squeezed from freshly ground raw vegetables may be given to the patient immediately after his noonday and evening meals, to increase his appetite and his ability to utilize large quantities of food. This treatment, recommended by Russell for patients with pulmonary tuberculosis, is equally adapted to patients who have tuberculosis of the bones and joints.

Treatment should be continued for a long time, as it takes from one to three years for even a child to recover fully from a tuberculous lesion.

CHAPTER XIX

TUMORS AND DEFORMITIES OF THE LEG AND FOOT

TUMORS

Callus.—A callus is a thickening of the epidermis due to its repeated pressure between a bone and some hard surface outside of the body. When this repeated pressure first occurs, blisters may be formed. If the traumatism is often repeated, the epithelium thickens, and a callus results.

In many instances a callus is a protection to the body, and need not be disturbed. In some cases, however, it becomes so hard that the underlying sensitive skin is painfully pressed upon. This is especially true of calluses upon the sole of the foot. Under such circumstances the outer portion of the callus should be removed.

Before cutting away the outer portion of a callus the skin should be thoroughly softened by soaking it in a hot alkaline solution. Washing soda answers well for this purpose. The outer portion of the callus should then be scraped or pared away. The process should be repeated on succeeding days until the skin becomes sufficiently flexible. Great care should be taken not to cut into the living skin, as infection started in this manner often burrows beneath the callus, and is extremely difficult to stop (p. 529). Another method of removing a surplus callus is to apply to it an ointment containing salicylic acid, a dram to the ounce; or it may be painted with salicylic acid collodion. Two or three days later the first layer of thickened skin will have softened so that it can be removed from a considerable area. The acid should then be reapplied, but care should be taken to confine the subsequent applications to the portion of skin which is still abnormally thick. Flatfoot or other deformity which causes the excessive pressure should be corrected, and suitable shoes should be provided.

Corn.—A corn is a circumscribed thickening of the epidermis, usually occurring at a point where the skin is pressed between a bony prominence and the shoe. In these respects it resembles a callus. It differs from it in possessing a central peg, or core. Another point of difference is the possibility that a corn may develop between the toes. Such a corn is often kept in a macerated condition by the moisture, and is therefore called a soft corn.

The treatment of a corn is similar to that of a callus. After the outer portion has been softened and removed, the central peg should be dissected out. In some corns there are more than one of these conical thickenings. Salicylic acid is the active principle of most of the advertised corn cures. The treatment of a soft corn is similar, but, owing to the more delicate nature of the skin, applications should be milder, or should be left in place for a shorter period. Shoes should be changed so that pressure upon the affected spot may be avoided; but even when this is accomplished, it takes a long time to overcome the tendency of the epithelium to conical thickening.

Varicose Veins.—Varicose veins come chiefly to notice as one of the predisposing causes of ulcer of the leg. They may even without ulceration give the patient so much trouble that he seeks surgical relief. They are most commonly found in women who have borne many children, and who during their pregnancies have been obliged to be on their feet all day long, in spite of warning pains in the thighs and legs; but any person who is on his feet a great deal may have varicose veins.

The veins that become distended may be few or many. They may also be large or small. The internal saphenous vein and some of its branches are most often affected. The trouble may extend from the toes to the groin, or it may be limited to some portion of the extremity. The skin often becomes erythematous and pigmented in places, and may easily break down and ulcerate.

The chief symptom of varicose veins is an aching pain and heaviness in the affected leg. Edema, especially toward night, is [illegible]. If the veins become inflamed, as they often do, the [illegible] tender, red, edematous [illegible] vein can often be [illegible] (See [illegible], p. [illegible].)

TREATMENT.—The best palliative treatment for varicose veins is an elastic bandage, to be applied in the morning before the patient leaves his bed, and to be taken off at night (p. 527). If this is too much trouble, an elastic stocking may be worn. Naturally, such treatment will not cure the dilatation, but it will prevent it from increasing, and will relieve the patient of the pain which often accompanies enlarged veins, and will avert the more serious sequelæ—rupture, ulcer, and phlebitis.

If more radical treatment is called for, the affected vein may be ligated in a number of places. This operation is easily carried out under a local anesthetic, each incision half an inch to an inch in length, being made directly down upon an enlarged venous trunk, parallel to its lumen. The vein being exposed is separated from its bed, ligated in two places, and divided between the ligatures. If the blood current is interrupted in half a dozen places in this manner, and especially if the saphenous vein is ligated just below its termination at the saphenous opening at the upper end of the thigh, the effect upon the general dilatation will be considerable. Each wound in the skin should be closed with silk sutures.

A more radical operation is the removal of an entire dilated vein, or of its most prominent portions. When the vein is exposed by a skin incision, it can be dissected out of its bed partly by blunt instruments and partly by scissors. This operation may be carried out by using a local anesthetic, or a general anesthetic may be preferred. A light ligature above the operative field keeps the veins full, and the dissection should be made from below upward. The surgeon should be on his guard against troublesome bleeding which can easily follow the division of a deep branch, whose mouth is sometimes found with difficulty. On account of this risk of loss of blood, as well as because of the more extensive incisions, this operation should be followed by a rest in bed of a few days, which the simple ligation and division of the veins does not require. After either operation a dry dressing should be applied and kept in place until the stitches are removed on the fifth day.

The choice of treatment for dilated veins of the leg will depend not only on the size and situation of the veins, but still more on their number. If veins on all sides of the limb are much enlarged, it is a hopeless task to attempt their cure by removal, especially as the deeper branches will in such instances be found to be dilated also. If, on the other hand, a single large trunk with a few branches is involved, a permanent cure may be effected, even if the dissection has to extend from the ankle nearly to the saphenous opening.

In this last class of cases the subcutaneous method of dissection recommended by Mayo is of service. He exposes the vein high up, divides it. and passes over the lower portion an instrument which resembles a dull wire curette. This can be wormed along beneath the skin, dissecting out the vein until it breaks, usually three or four inches from the first exposure. The beak of the instrument is then pushed against the skin and cut down upon. The lower end of the vein is seized, the instrument is withdrawn and passed over the vein in the new opening, another worming downward takes place until the vein again breaks, etc. Side branches as they are torn off may be followed or simply ligated according to their size.

Aneurism.—The popliteal artery is the one artery of the lower extremity especially liable to undergo dilatation. The diagnosis is easy even in an early stage if one tests for expansile pulsation. The only other cystic swelling in this vicinity is distention of the bursa under the inner head of the gastrocnemius and tendon of the semimembranosus muscles. The distended bursa is not situated in the same place as the popliteal artery and it does not pulsate (p. 481).

The cure of aneurism by pressure and by operation is fully discussed in text-books on major surgery. Since the improvement of operation for this lesion, other methods of cure are seldom employed; and yet it is worth remembering that many cases of popliteal aneurism have been cured by digital pressure continued by frequent changes of assistants one or two days, until the blood in the sac coagulates.

Ganglion.—This may occur in the foot as well as in the hand (but it is rare). It may be treated by aspiration and injection or by excision. (For diagnosis and treatment see p. 445.)

Sebaceous Cyst.—This tumor, so common in the upper portion of the body, is seldom found below the hips. (For diagnosis and treatment see p. 67.)

Lipoma and Fibrolipoma. — These tumors are occasionally found on the thighs. (For their diagnosis and treatment see p. 185.)

Fibroma.—A tumor of the appearance of a pure fibroma should always be looked on with suspicion, and subjected to a careful microscopic examination. It will often turn out to be a sarcoma, either spindle-celled or made up of small round cells.

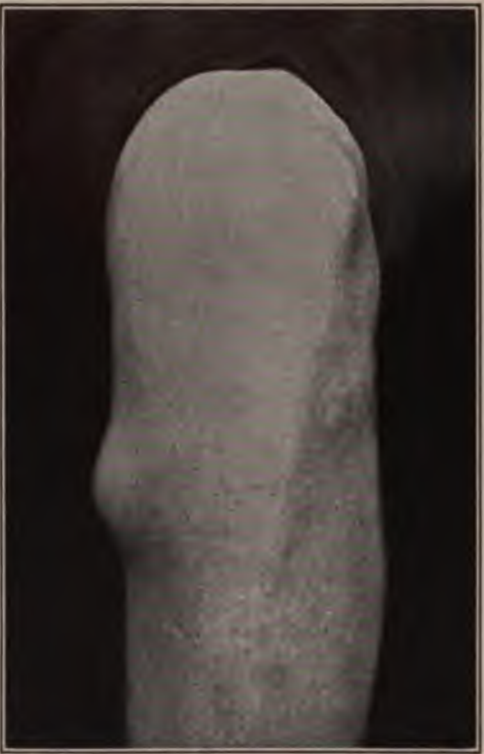


Fig. 287.—Osteoma of the Tibia of Three Years' Duration in a Boy aged Fourteen Years.

Osteoma. — Any bone may be the seat of an osteoma. In the lower extremity these tumors are chiefly found growing from the femur or tibia (Fig. 287) or from the dorsal surface of the last phalanx of the great toe (Fig. 288). The nail is lifted from its bed by the tumor, which grows almost directly upward.

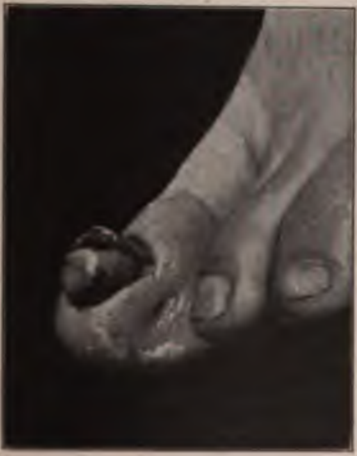


Fig. 288.—Osteoma of the Great Toe Growing under the Nail and Pushing the Nail Before It. Duration five months; patient a woman aged thirty-four years.

Treatment.—If an osteoma is troublesome, it should be removed together with its attachment to the bone. A pathological examination should always be made to rule out the possibility of osteosarcoma. The osteoma of the tibia shown in the illustration gave no trouble. Such a tumor should be radiographed and then merely be kept under observation to rule out the possibility of malignancy. The osteoma under the nail prevented the comfortable use of an ordinary shoe, and was therefore removed.

Sarcoma.—All kinds of sarcomata are found in the lower extremity, and they may arise in any tissue plane from the skin to the marrow of the bones. The forms that are especially likely to lead to a mistake in diagnosis are sarcoma of the knee or of the femur near the knee, simulating tuberculosis; sarcoma of the shaft of a bone, especially of the tibia, simulating syphilis; sarcoma of the skin or subcutaneous tissue, simulating fibroma, and sarcoma of the toes, simulating senile or diabetic gangrene. An instance of the last named type is shown in Figure 289. It developed soon after a traumatism, as sarcoma often does.

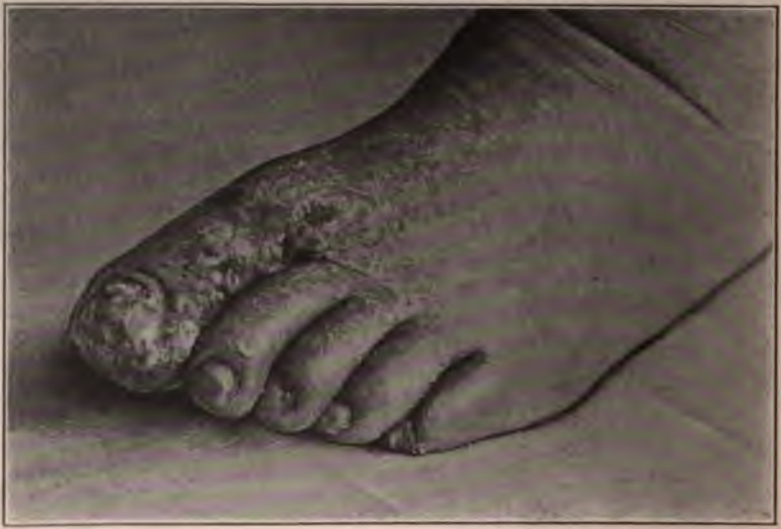


FIG. 289.—SARCOMA OF GREAT TOE FROM INJURY NINE MONTHS PREVIOUS. Patient a man aged fifty-one years.

TREATMENT.—As soon as the diagnosis is made the tumor should be removed, and with it enough of the healthy tissue to make recurrence unlikely. This usually means an amputation. The only sarcomata therefore whose treatment lies within the field of minor surgery are those which arise in the skin or close to it. The removal of such tumors has been described on page 462. The deeper sarcomata of the lower extremity afford some of the hardest problems which the surgeon has to solve.

Carcinoma.—A carcinoma of the lower extremity almost always starts in an ulcer. Although this is not a common outcome of an ulcer of the leg, it is worth bearing in mind. Fortunately such a tumor in its early months does not extend far below the surface nor form metastases, and it can therefore be easily removed, and will not be likely to recur.

The hard growing edges and sloughy base of such an ulcer give it a characteristic appearance in many cases (Fig. 290). In other cases the appearance is less characteristic, and it may be necessary to remove a section for microscopic examination before an absolute diagnosis can be made.

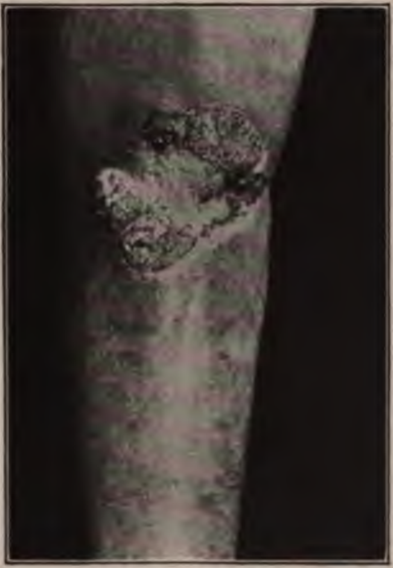


FIG. 290.—CARCINOMA DEVELOPING IN AN OLD ULCER OF THE LEG OF A FEMALE PATIENT.

TREATMENT.—If an ulcer or any portion of it is found to be carcinomatous in character, it should be at once removed, the cut being well away from suspicious tissue. In most cases it will be found advisable to cover the wound with skin-grafts, either at the time or after granulations have formed (p. 577). Such an operation, unless the area is very small, can best be carried out with a general anesthetic, and requires a few days' rest in bed.

ACQUIRED DEFORMITIES

There are several deformities acquired from ill-shaped shoes which are amenable to ambulant treatment. These deformities may be of the nails (twisted nail, ingrown nail), or of the toes (hallux valgus, hammer-toe), or of the foot (flatfoot, weak foot). In all these deformities proper shoes should be insisted on. But a change from bad to good shoes will not repair the mischief done except to a slight degree and often enough the patient has made such a change long before consulting the surgeon.

Twisted Nails.—Twisted nails are found usually in old persons, both men and women, and are due to long continued pressure of pointed or short shoes. By such pressure on the nails the matrices have been twisted, and the nails grow out in a curve toward the outer margin of the foot. This tendency can be observed in many persons, but it is especially prominent in the aged, whose nails often become so thick that they are cut with difficulty (Fig. 291). Such nails are sometimes allowed to grow very long before medical assistance is sought for. They can be clipped short with wire nippers or bone shears, without an anesthetic, or cocain may be inserted around the base of the nail, the skin loosened and pushed back, and the nail twisted over and removed. In the latter case a dressing will be required for a few days to protect the toe until the slight tenderness has disappeared. The new nail as it grows out will be like the old, but the patient will have relief for a year or more.

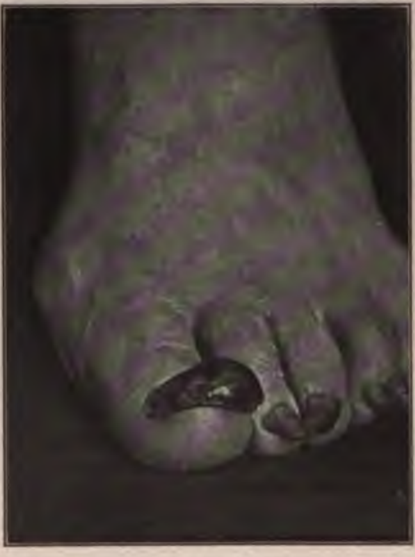


Fig. 291.—Twisted Nails of Three Years' Duration. Patient a woman aged thirty-three years.

Ingrown Nail.—This is a condition in which the edge of the nail, usually of the great toe, by its too close contact with the flesh beneath causes irritation, ulceration, or suppuration. There has been much discussion as to whether the nail or the flesh is the more at fault. This discussion is without profit. It is much better to study the normal conditions, and see what can be done to restore them. Figure 292, *A* and *B*, shows the normal toe-nail in longitudinal and transverse section. The drawings are from the toe of a young male adult. It is important to note the relations of the matrix of the nail to the first phalanx and to the joint; since the bone and joint are landmarks in the performance of the operation for the cure of ingrown nail.

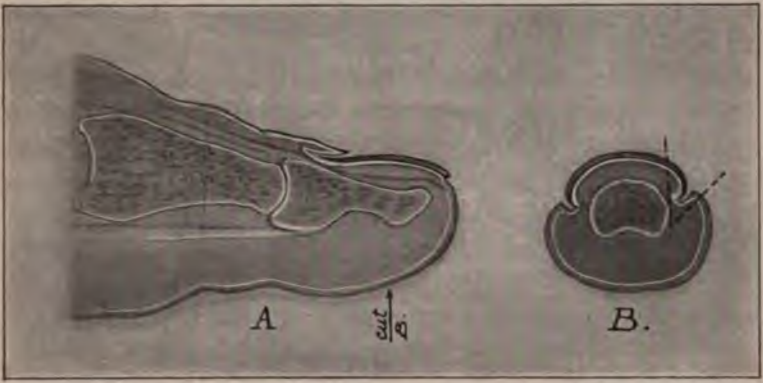


FIG. 292.—SECTIONS OF THE GREAT TOE TO ILLUSTRATE THE PATHOLOGY OF INGROWN NAIL ON WHICH SUCCESSFUL OPERATION IS BASED. The nail is shown dark, the matrix light. Note that the matrix extends almost to the joint. *A*, longitudinal section; *B*, transverse section at point in *A* marked by the arrow The dotted lines mark out the portion of the nail and matrix which should be removed.

If the nail is allowed to grow out to the end of a normal toe, the ordinary pressure of the shoe brings the edge of the nail against the underlying skin at the end of the toe where the skin is tough, so that no damage results. If an ill-fitting shoe constantly rubs the toe, or if some one steps on it, the trauma may break the underlying skin. The edge of the nail will then be in constant contact with the sore, and will act like a foreign body, and prevent the ulcer from healing.

This is especially true if the corners of the nail have been cut away, so that the pressure of the nail's edge comes on the more delicate skin by the side of the nail, rather than on the tougher skin at the end of the toe. The resulting inflammation, ulceration, and granulation may go on until the toe presents the appearance shown in Figure 293.

Such a toe is very painful, and the pain is only partly relieved by cutting away the upper of the shoe, etc. As there is an easy exit for the discharge, infection rarely extends upward into the foot and leg. On the other hand, the conditions for repair are not good, so that a patient may go hobbling about for months with a small ulcer under the nail's edge, marked by an exuberant growth of granulations and a slight discharge.

TREATMENT.—There are three ways to cure the existing ulcer of an ingrown nail: (*a*) One is to interpose some protecting material between the edge of the nail and the ulcer; (*b*) another is to remove the edge of the nail from the ulcer; (*c*) and the third is to remove the flesh from the edge of the nail.

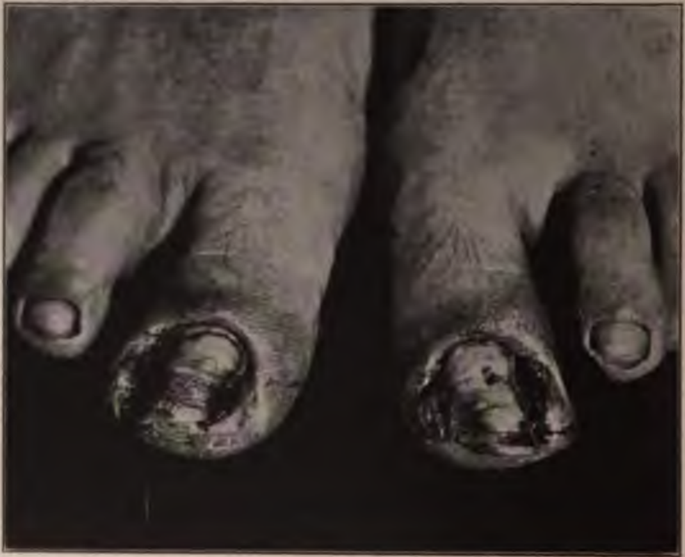
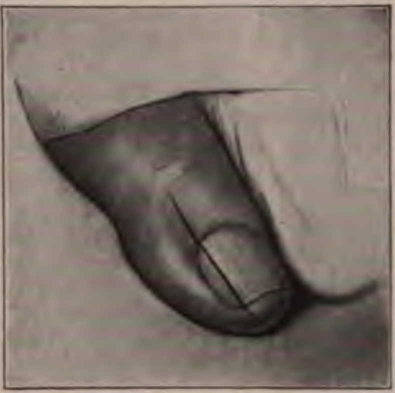


FIG. 293.—INGROWN NAILS OF BOTH GREAT TOES, DURATION ONE YEAR. Patient a boy aged fifteen years.

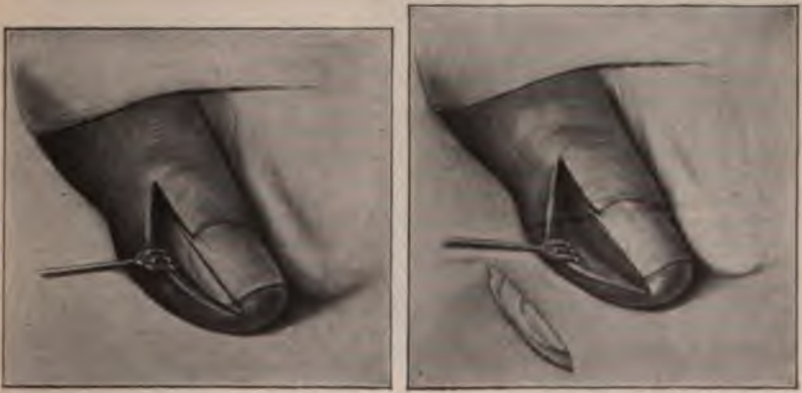
In mild cases the ulcer due to an ingrown nail may be cured by depressing the flesh along its edge and pushing a small wisp of absorbent cotton under it. This should be wet with some astringent solution, for example, silver nitrate, 1:50. The upper of the shoe should be cut from the sole far enough to relieve the great toe from pressure. The dressing should be changed every day or two. Cotton should be kept under the edge of the nail until the corner of the latter has grown out to the end of the toe. Otherwise the ulcer is likely to reform.

The nail can be pushed upward away from the ulcer by means of a little silver hook. A thin strip of spring silver is so bent that it will hook under the edge of the nail, and then half encircle the toe, on its plantar surface. As the patient steps on the toe the buried edge of the nail is lifted upward. The hook is kept in place by adhesive plaster or a bandage. This method, like that of cotton and astringents, finds its best use in mild cases occurring in people of some intelligence.

The edge of the nail may be pared away, and so separated from the ulcer. This is the treatment of many patients as well as chiropodists. It often gives temporary relief if the ulcer does not extend too near the matrix, but it can cure only mild cases of ingrown nail, for as the nail grows out its corner digs again into the flesh. For the same reason, "tearing out by the roots" the whole or a part of the nail is doomed to failure. The matrix cannot be torn out, and will grow another nail at least as distorted as its predecessor.



A



B C

Fig. 294.—Operation for Ingrown Nail. *A*, The line of incision; *B*, the skin flaps reflected; *C*, the section of nail and corresponding matrix removed.

A satisfactory radical operation must remove, with the edge of the nail, that portion of the matrix from which it grows.

The details of this operation are as follows: Cleanse the toe as thoroughly as possible with soap and water and an antiseptic solution; shut off the blood-supply of the toe by a bandage tied about its narrowest part. Inject a local anesthetic along the edge of the nail and beneath it as far back as the base of the second phalanx. Cut through the nail and overlying skin in a line parallel to the axis of the toe (Fig. 294, *A*). This cut should separate from the nail a strip about one-fourth of an inch wide, and should extend clear through the matrix of the nail—a dense white layer easily differentiated from the subcutaneous fat (Fig. 292, *A*, p. 545). The overlying skin at this side should be dissected free from this separated marginal strip of nail and from its matrix (Fig. 294, *B*).

This strip of nail and matrix should be dissected out by cuts made above and below it, and meeting well beyond it under the skin at the side of the toe. The surgeon should remember that the nail grows from the thick layer of epithelial cells placed both above and below the plane of the nail, the former extending nearly to the reflection of skin, and the latter extending to the white semilunar line. The skin flaps are retracted and the wound is inspected for any possible bit of matrix which may have been left (Fig. 294, *C*). It is then well wiped out with an antiseptic solution, such as a solution of bichlorid, 1:2,000, and closed by the pressure of a wet dressing wrapped around the toe; ligation of blood-vessels is rarely necessary, especially if the dressing is partly applied before the constricting bandage around the toe

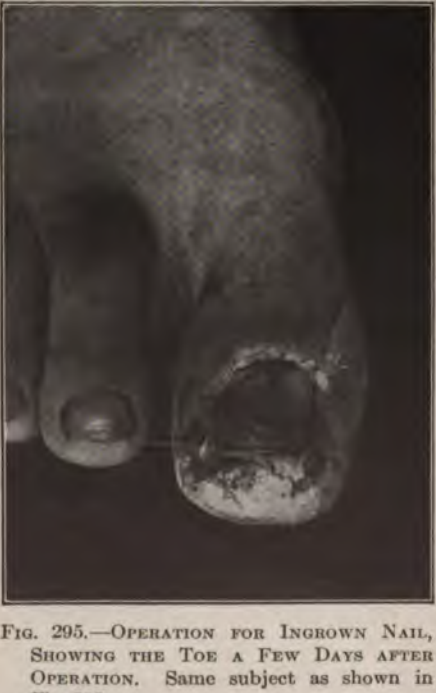


FIG. 295.—OPERATION FOR INGROWN NAIL, SHOWING THE TOE A FEW DAYS AFTER OPERATION. Same subject as shown in Fig. 293.

is removed. Too great pressure must not be applied to the lateral flap, however, lest sloughing or infection follow. The shape of the wound facilitates drainage if a wet dressing is put on and frequently moistened. The dressing should be changed daily for four days; then if all is well, a dry dressing may be substituted and changed again every three or four days. If the wound heals as it should, it will be quite closed in ten days (Figs. 295 and 296). The proximal half usually closes by "first intention." Sutures may be inserted, but are not necessary.

The disfigurement after this operation is slight, and the functional result is perfect.

In performing the above described operation, one should bear in mind that every bit of the nail has its corresponding portion of the matrix from which it springs and that growth of the nail, except in cases of distortion, is parallel to the long axis of the toe. One should not, therefore, remove a broader portion of the matrix than will correspond to the buried portion of the nail. When this rule is followed, the visible portion of the nail will continue to be formed and the normal appearance of the toe will be preserved.

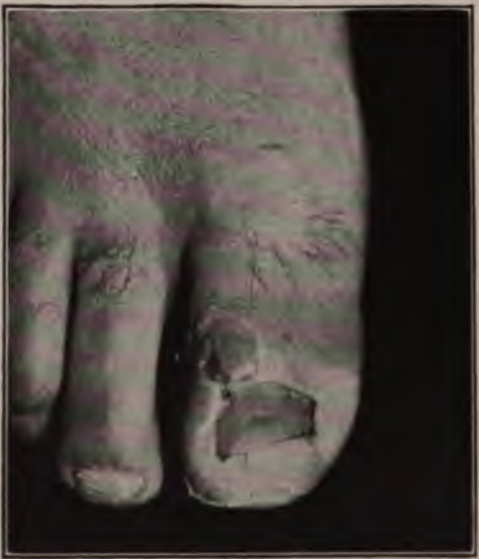


FIG. 296.—OPERATION FOR INGROWN NAIL, SHOWING TOE TEN DAYS AFTER OPERATION. The length and position of the skin incision are plainly shown by the recent scar.

If a portion of the matrix is left in the operative field, it may grow up by the side of the nail in harmless stubs of nail, or, if larger, it may grow a long spike of nail which pierces the skin at the side of the toe and renders a second operation necessary, or it may be unable to pierce the skin and will then curl up, forming a subcutaneous mass of half hardened epithelial débris.

The operation above described has been developed in the hands of the author from several cruder ones, based on the same principle, of removing the matrix of the offending portion of the nail. Some of them were less certain in accomplishment, and some more painful in execution, and some more mutilating. Some operators, in addition to the removal of the matrix of the involved part of the nail, tear out the whole formed nail. This has no advantage, and renders the toe more or less sensitive for some weeks.

The third method of separating the edge of an ingrown nail, and the ulcer it causes, is by removal of the ulcer. This is accomplished by cutting away the skin and subcutaneous tissue of the side of the toe. As there is then nothing for the nail's edge to press against, the soreness quickly disappears. The wound left to granulate is from half an inch to an inch in diameter; so that healing takes a month to six weeks. The ultimate result is good, but the shape of the toe is somewhat altered in appearance. This operation bears the name of Cotting.

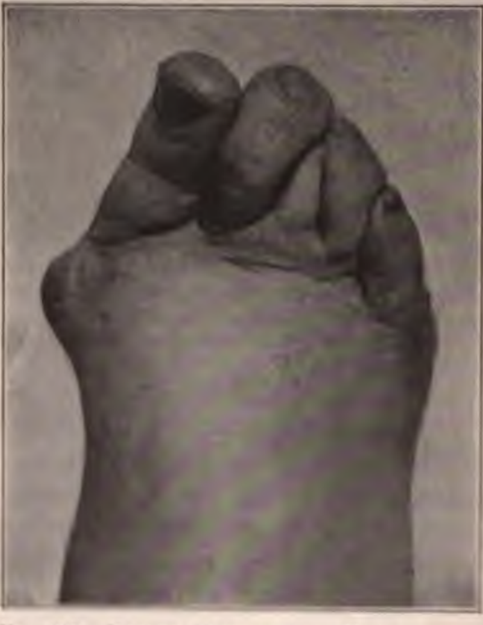


Fig. 297.—Hallux Valgus, with Hypertrophy of the Head of the First Metatarsal, and Displacement of the First Toe Outward. Note the overriding of the other toes. The deformity was of many years' duration; the patient a woman aged seventy-two years.

Hallux Valgus.—Hallux valgus is a gradually formed abnormal abduction or partial dislocation outward of the great toe, due to wearing short or pointed or high-heeled shoes. It is often combined with an inflammation of the metatarsophalangeal bursa, often called a bunion (p. 482), and with hypertrophy of the head of the first metatarsal

(Fig. 297). As the great toe is swung further toward the outer side it may come to lie either above or less often below the second toe. The pull upon the capsule of its joint and the hypertrophy of the head of the metatarsal, which takes place almost entirely on its inner side, so alter the plane of the joint that in extreme cases it comes to be as oblique as the line drawn from the base of the first phalanx to the base of the fifth metatarsal.

The symptoms of hallux valgus vary greatly even in the cases uncomplicated by bursitis. In the simplest cases there may only be a little dull pain, due to the more or less constant pull on the inner side of the capsule or due to the pressure of the shoe against the exposed and enlarged head of the metatarsal. In other cases the pain may be so great as to make walking very difficult. If there is simple or suppurative bursitis, there will be corresponding signs of inflammation of the soft parts with great pain and tenderness, somewhat modified by the imperfect drainage which often takes place through a small sinus (Fig. 298).

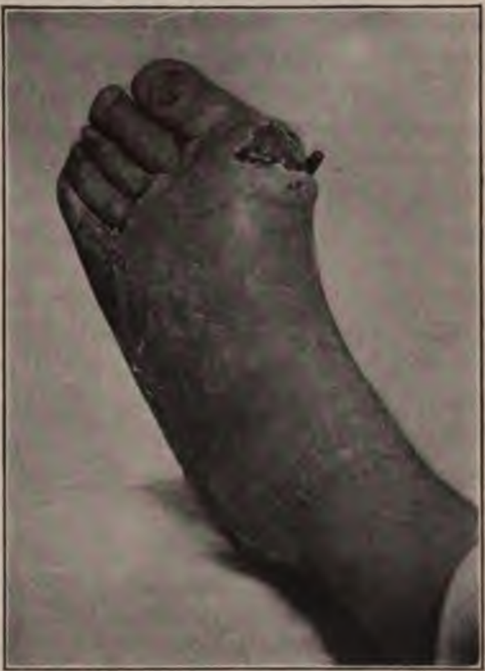


Fig. 298.—Hallux Valgus, with Hypertrophy of the Head of the Metatarsal and Suppurative Bursitis and Synovitis. A small rubber drain is in the sinus. Patient a man aged thirty-eight years.

Treatment.—Non-operative treatment of hallux valgus is palliative, and in the early stages, curative. Ill-fitting shoes should be discarded, and broad-toed shoes selected which fit snugly around the instep and leave plenty of room for the toes. Most people consider such shoes ugly, so that they should not be unnecessarily broad. The introduction of a toe-post to separate the first toe from the others, should not be advised; for in cases in which the deformity is marked, operation is clearly indicated. High heels, by flexing the toes, tend to increase any existing lateral deflection whenever the patient bears weight on the foot.

The patient should practise several times a day voluntary contraction of the adductor muscles of the great toe. At first this may be impossible, but repeated effort will soon restore the lost power over these muscles. This practise will tend to correct the existing deformity and also to develop the fibrous protection on the inner side of the joint. Bathing with cold water, rubbing with alcohol, and other measures of a similar character are serviceable. Counter-irritants, such as guaiacol or iodine, may lessen the pain.

Treatment by Operation.—Hallux valgus in its severer forms is amenable to operative treatment. A number of methods have been suggested, of which the one described is probably the simplest and best. This conclusion seems warranted both on theoretical grounds and because of the excellent results which follow it. It is best performed under general anesthesia. An incision slightly concave upward is made along the side of the joint at about the margin of the thick plantar skin. An incision so placed will give a scar too low to be pressed against the upper of the shoe and too high to be pressed against the sole of the shoe. The incision should be about two inches in length. Skin flaps—especially the upper one—are dissected free and retracted. The bursa, if inflamed, should be dissected out and removed entirely. The capsule of the joint is opened by a longitudinal incision. An estimate is then made of the amount of the head of the metacarpal which it will be necessary to remove in order to correct the plane of the joint and to allow the toe to lie in a correct position without force. The capsule should then be reflected from such a portion of the metatarsal and the partial resection of the head of the bone carried out. This may be done with a bone forceps or with a small chisel. In either case splintering of the bone is to be avoided by having the tools sharp and by cutting only a little of the bone at a time. The piece of bone resected should be wedge-shaped, the base of the wedge being directed inward, but the resection should extend clear to the outer side of the metatarsal in order to avoid tension on the external portion of the capsule when the toe is brought into a correct position. Superfluous knobs of bone on its inner aspect should now be chiseled away, and the cut surface of the metatarsal, which must now form the joint with the first phalanx should be rounded to conform to the normal bone. The phalanx is not hypertrophied and should not be cut into. This will insure a movable joint except in suppurative cases in which the cartilage of the phalanx has sloughed.

The cavity of the joint should be irrigated with saline solution and wiped clean. If sufficient bone has been resected, the position of the toe can be corrected with very little force. An excess of capsule from the inner side should be removed by cutting out of it a transverse ellipse and suturing the cut edges. In a suppurative case the joint should be drained by a wick of gutta-percha tissue. The skin incision should be partly or wholly sutured and a small dressing applied, while the toe is held in an overcorrected position by a suitably padded lateral splint.

This splint should under no circumstances touch the region of the joint. It should be moderately padded where it comes in contact with the heel, and very thickly padded opposite the tarsus. It should then be firmly bandaged to the foot. The toe can then be approximated to the splint more or less according to circumstances. In this manner the wounded or inflamed area will not be pressed upon at all (Fig. 299).

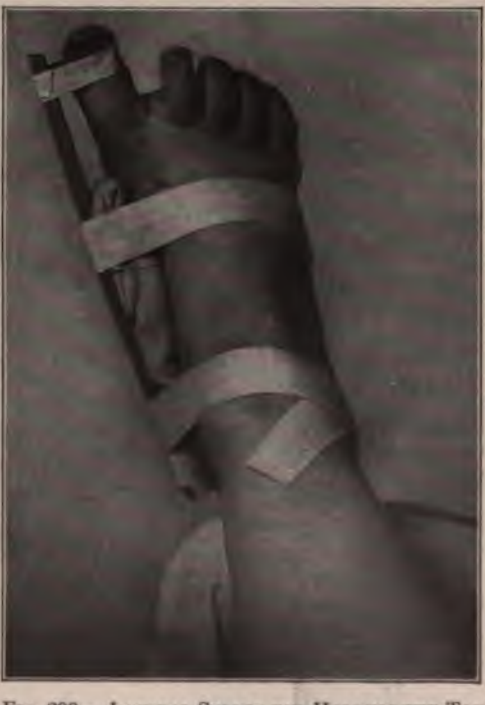


FIG. 299.—LATERAL SPLINT FOR HOLDING THE TOE AFTER OPERATION FOR HALLUX VALGUS.

The wound should be entirely healed in from ten to twenty days, and a movable joint should be obtained. In favorable cases the patient can go about on crutches from the start.

While such a result may be anticipated in clean cases, and even in those in which the infection is mild, there are other cases in which the suppuration of the joint has already caused the erosion of the cartilages and possible necrosis of some of the bone. Under such circumstances free drainage must be maintained for a considerable time. There will usually be a sinus, and possibly an ulcer, to the inner side of the joint which will determine the site of the lateral incision. Through this the joint cavity should be widely opened, and so much of the head of the metatarsal bone should be removed as may be necessary to correct the deformity. This gives the surgeon a good view of the interior of the joint and of the opening into an abscess cavity, if one has already formed, as is frequently the case, between the bases of the first and second phalanges. Such an abscess will require additional drainage on the dorsum of the foot, or between the first and second toes. The foot should be put up in a wet dressing. A week later, when the acute symptoms will have subsided somewhat, it will be time enough to apply the lateral splint.

Hallux Rigidus.—As the name implies, this is an affection of the great toe, marked by stiffness of the metatarsophalangeal joint. The toe may lie straight ahead or be slightly flexed. The affection is often seen in early adult life. It is often associated with flatfoot. In the later stages, the joint becomes distinctly thickened, as it does in hallux valgus.

If hallux rigidus is an accompaniment of flatfoot, the symptoms may disappear with the cure of the flatfoot. If this is not the case, the pain in walking may be greatly relieved by stiffening the sole of the shoe with leather or a steel plate, so that the shoe does not bend opposite the affected joint. If the symptoms are extreme, excision of the joint or amputation of the toe may be necessary.

Hammer-toe.—Hammer-toe is a deformity resulting from the wearing of short shoes. Usually only one toe is affected, either the second or the third. Often the deformity exists in each foot. It is more often found in slim persons with long toes.

The toe is sharply flexed at the first phalangeal joint, while the third phalanx may or may not be overextended. There is usually a painful corn over the first phalangeal joint. The ligaments and tendons will often be found too short to permit the toe to be fully extended.

A hammer-toe may be cured by an incision across the flexor side of the first phalangeal joint. This cut should divide skin, flexor tendons, and the capsule of the joint, so that the toe may be fully straightened and easily kept straight. It is sometimes of advantage to divide the extensor tendon in the middle of the proximal phalanx. The incision on the flexor side of the toe may be partly or wholly closed by sutures inserted from side to side, thus changing the transverse incision into a longitudinal one.

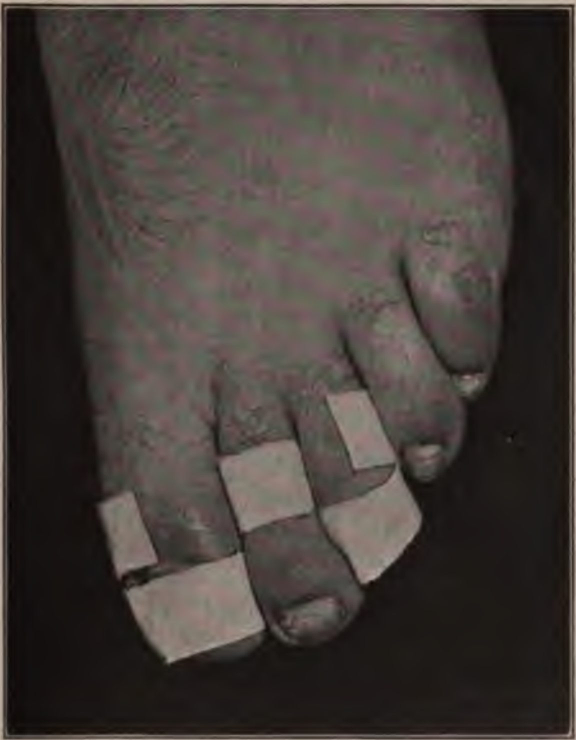


FIG. 300.—INTERWOVEN ADHESIVE STRIPS FOR CORRECTING THE DEFORMITY OF HAMMER-TOE AFTER OPERATION.

This little operation is nearly bloodless, and is easily performed with a local anesthetic on even a sensitive individual. A light dry dressing should be applied to the toe operated on, and two strips of adhesive plaster should be woven through the affected toe and its fellows on either side in such manner as to hold down the first phalangeal joint and to hold up the end of the toe (Fig. 300).

This interweaving of adhesive plaster is not uncomfortable and should hold the toe perfectly in a correct position. It should be kept up for weeks if there is any tendency toward the recurrence of the deformity.

The operation above described is suited to a toe with flexible joints and plenty of skin. In long standing cases the skin and fascia on the under surface are insufficient to cover the toe in its extended position. In such cases it is better to resect the head of the first phalanx through a linear lateral incision. After the bone has been resected the flexor tendons and the deep fascia can be divided transversely through the incision already made. The toe will then lie in an extended position without the use of force, and has only to be kept there during the healing of the wound. The wound should be sutured without drainage.

If a hammer-toe is thick and painful, and if the pressure upon the end of the toe has produced marked deformity of the nail, amputation of the terminal phalanx or the last two phalanges may be indicated. This is especially the case if the patient is in middle life or beyond. The plantar skin should be preserved in order to make a thick and painless flap.

Flatfoot.—In flatfoot, two abnormal conditions are found, combined or alone—a weakness and sinking of the longitudinal arch of the foot and a rigidity of the metatarsotarsal and tarsal joints. These facts can be determined by inspection and manipulation of the feet, by observing the effect of standing with and without resting the weight of the body on the suspected foot, by the gait, and by noting the imprint of the foot when weight is borne upon it. The symptoms are pain in the feet and legs, especially after standing, an unnatural, stumpy gait, the patient not rising on the balls of the feet, and in some cases swelling of the feet.

Physical examination is most important. Both feet and legs should be bared to the knee, and the patient asked to stand upright, putting the weight first on one foot and then on the other. If the foot is merely weak, the arch will sink when the weight is placed upon it; if it is also rigid, the breaking downward of the arch will be manifest whether or not the weight is placed upon it.

The second test is one of manipulation. The patient's foot should be rested upon the examiner's knee. If the left foot is examined, the doctor's left hand should grasp the heel, but the ball of his left hand should rest against the center of the arch. With his right hand he should grasp the heads of the metatarsals, the palm of his hand resting against the outer border of the foot. In this manner he can test the amount of flexibility of the foot, and can also estimate the amount of force required to bring it into a normal position. By allowing his two hands to sink between his knees, he can supplement the muscular actions of his arms by that of his thighs, thereby greatly relieving himself when attempting to correct bimanually any existing deformity (Fig. 301).

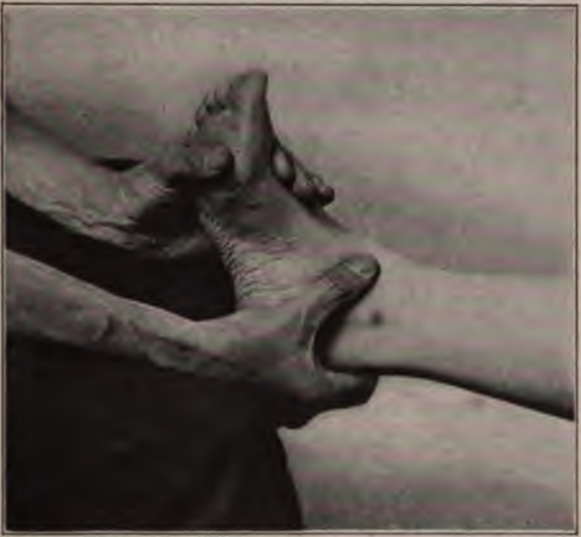


FIG. 301.—TESTING THE DEGREE OF RIGIDITY IN FLATFOOT, AND CORRECTING THE DEFORMITY.

The imprint of the foot, when weight is borne upon it, may be obtained by allowing the patient to step first upon a wet towel and then upon a board or upon blotting paper laid on a hard surface. A permanent impression is best obtained by inking a glass plate with printer's ink, in the manner employed for small printing presses, allowing the patient to step on the glass plate and then to step on paper. The ink is readily washed from the foot by soap and water.

TREATMENT.—If the flatfoot is due to weakness alone, and is of moderate degree, the patient should take exercises morning and night, turning the toes directly forward or slightly inward, and bearing the weight first on the heels and then on the balls of the two feet. This should be taken up gradually until it can be done thirty or forty times. The second exercise consists in walking around the room barefooted, with the toes turned in and spread out as much as possible, and the weight entirely borne on the balls of the feet, the heels being kept as high from the floor as possible. In the third place, the patient should learn to walk with the toes straight ahead. Patients with flat feet habitually turn the toes outward, to avoid lifting the weight of the body on the balls of the feet as they step forward. This faulty gait increases their deformity.

The fourth suggestion for treatment is the elevation of the inner half of the sole of the shoe by one or two thicknesses of leather. Both the heel and the ball of the shoe should be so treated that the plane of the shoe where the foot rests upon it may be inclined slightly outward.

These simple rules, if persistently followed out, will cure many cases of flatfoot due to weakness. If rigidity exists, a correct relation of the bones must be brought about by manipulation before the measures above outlined can effect a cure. This manipulation is described above. It should be performed at least twice a week by the doctor, until the patient can voluntarily bring the foot into the correct position.

In the more severe cases of weak foot, and in almost all the cases in which rigidity is present, additional treatment is required. The manipulation above described must be carried out until the rigidity has disappeared; or if the rigidity is too great to yield readily to such treatment, or if the pain will not permit of the employment of much force, the patient should be etherized, the deformity forcibly corrected, and the foot put up in a heavy plaster of Paris bandage, markedly inverted, and with as much of an arch given to it as is possible (Fig. 302). The patient should go about in such bandages from four to eight weeks. In extreme cases it is advisable to apply a second or a third bandage, each time some gain in position being accomplished. It is worse than useless to fit a brace to the sole of the foot as long as there is rigidity in an incorrect position.

When the foot can be brought into a normal position a cast should be made of it in gypsum (see p. 710), and a steel support made from the cast, to be worn inside the patient's shoe. Such a brace will usually crack or rust in six months or a year, and it sometimes requires the purchase of specially made shoes; but these are slight inconveniences compared with the disability caused by well marked flatfoot.

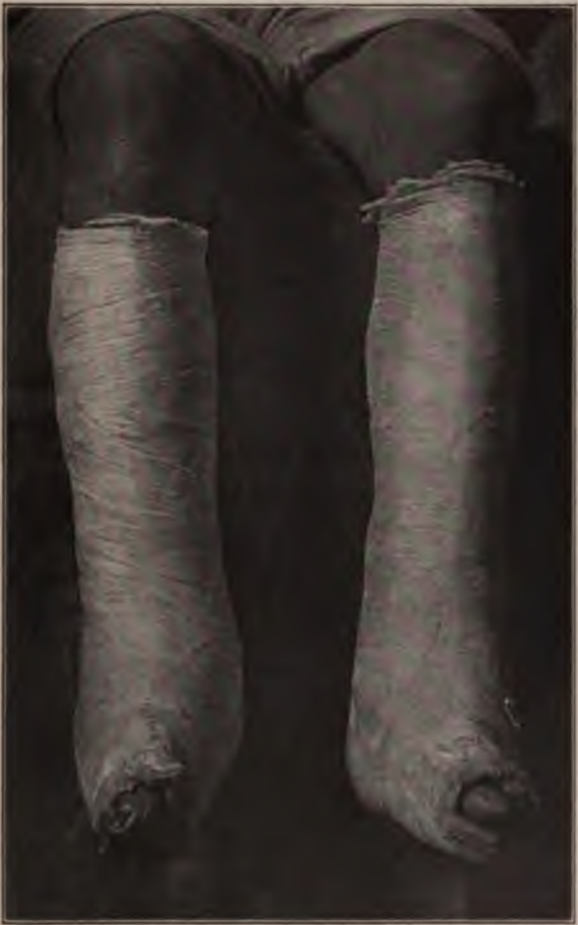


FIG. 302.—MARKEDLY RIGID FLATFEET PUT UP IN A CORRECTED POSITION IN CIRCULAR GYPSUM SPLINTS.

In some cases the wearing of braces for two or three years will so correct the deformity that the patient may go through life without braces and without special shoes.

While the treatment of flatfoot requires a good deal of time and trouble, there are no patients who are more grateful for the relief they obtain than these sufferers.

Transverse Flatfoot; Sinking of the Transverse Arch.—The transverse arch of the foot, formed by the heads of the metatarsal bones, may sink, giving rise to pain and disability. The pain in some of these cases has received the special name of metatarsalgia, or Morton's disease. It is thought to be due to an abnormal pressure of the head of one metatarsal bone against another, or against the sole of the shoe. The heads of these bones normally form a shallow arch. It is easy to see that the displacement of one of them may alter their relations. Sometimes this displacement is permanent, sometimes it only occurs when the patient steps on the foot.

In some cases a narrow shoe, by preventing the spreading out of the bones which compose the arch, is distinctly more comfortable than a broader shoe. A patient who has observed this fact may resent the idea that the shoe has anything to do with the deformity. It is none the less true that the wearing of short shoes and high heels, by producing dorsal flexion of the toes, brings an undue strain upon the transverse metatarsal arch, and predisposes it to give way.

TREATMENT.—What has been said of exercise and manipulation in the treatment of flatfoot is of equal value in the treatment of weakness of the transverse arch. If one metatarsal bone has sunk below its proper plane, a support should be placed beneath it. This can be made of sole leather with a beveled edge, and glued to the sole of the shoe, or a steel brace can be fitted to a gypsum cast made of the sole of the foot. The deformity in the cast should be corrected by paring away the projection which represents the displaced metatarsal bone. If rigidity coexists with weakness, a correct position of the arch should be obtained before a brace is fitted to the foot. The brace need not come so far up on the instep as the brace made to prevent sinking of the longitudinal arch.

If a callus has formed over the displaced metatarsal bone, the superfluous epithelium should be softened with salicylic acid and carefully peeled away. If such a callus is recklessly torn or cut into, it may form a starting-point for a most troublesome infection and ulceration (see p. 529).

Painful Heel.—Policemen, and others who stand a great deal, sometimes complain of severe pain in the plantar surface of the heel. This may be due to flatfoot, or simply to overuse of the part, or in some cases it may be due to inflammation of a small bursa. The patient should be advised to wear rubber heels, and if the pain is localized in a small area, the insole of the shoe should be cut away at this point, or raised over the rest of the heel in order to effect a different distribution of pressure.

CONGENITAL DEFORMITIES

Congenital deformities of the foot are analogous to those of the hand, but they are less often the subject of treatment because the toes are not used individually.

Hypertrophy of Toe.—Marked hypertrophy of one or more toes is a condition which calls for surgical treatment, on account

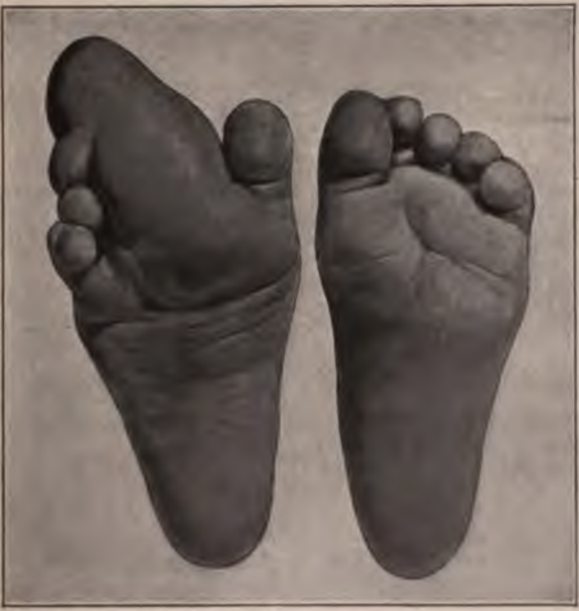


FIG. 303.—CONGENITAL HYPERTROPHY OF SECOND TOE.

of the awkwardness due to the great size of the hypertrophied member (Fig. 303). Amputation of the superfluous tissue is called for, so that the patient may be able to wear ordinary shoes, and also to reduce the risk of malignant degeneration, which is a not very unusual change in tissue of this character.

Supernumerary Toe.—Supernumerary toes are about as common as supernumerary fingers. Their removal, however, is not usually sought for unless they project at an angle.

SECTION VIII

MINOR SURGICAL TECHNIQUE

CHAPTER XX

OPERATIVE TECHNIQUE

The Conditions of Operation.—In no part of the field of surgery ought the results obtained to be any better than those obtained in minor surgery. The patient who requires treatment of this character, whether operative or not, is usually in good health; there is little shock or loss of blood to be recovered from; and nutrition is not disturbed by a long confinement to the bed. In all these respects the condition of the patient is favorable to rapid recovery. If the doctor's work is of the high character which has justly made famous some other branches of surgery such rapid recovery and without complications will be assured. Yet the ease with which primary union is obtained in a small wound made upon a healthy child or young adult must not be allowed to induce careless methods of treatment.

Asepsis.—Successful surgery is clean surgery. It is easy to say " the operation should be performed with due regard to the principles of asepsis," and this is literally true of the smallest operation. But common sense tells us that while the same principles underlie recovery from a prolonged laparotomy and from a scalp wound, much of the preparation which is essential for the former is unnecessary for the latter. A brief statement of the essentials of a clean minor operation is therefore desirable.

The Operating-room.—The room is not an essential. Good results should be obtained by the roadside, in a machine shop, or barn, as well as in the doctor's office; but those who have much work of this sort to perform will naturally fit up a room with a floor of tiles or hardwood or covered with linoleum, so that it can be easily washed. It should have a good light, both natural and artificial. It should be furnished with a table for the patient, one or two tables for instruments and dressings, two chairs or stools, a case for instruments, a water-supply, an irrigator, a slop sink, a pan for boiling water and sterilizing instruments, and a steam sterilizer for dressings. Everything should be of a character to make it easily cleaned. The sterilizers need not be elaborate. An asparagus boiler answers well for instruments, and an Arnold Steam Sterilizer does well for dressings. Many prefer to omit the latter and buy gauze ready sterilized in packages.

Preparation of the Patient.—Usually the patient comes without preparation, frequently soon after a full meal. This really makes little difference, even if he is given a general anesthetic. The danger from vomiting during anesthesia is much exaggerated. Certainly "aspiration pneumonia" need not be greatly feared. If he vomits, the material should be given free exit and his mouth wiped out; that is all.

The clothing should be removed from the part to be operated on and its vicinity. If this is not done the patient is likely to go away with a bloody shirt or dress. It is no excuse that the patient is so excited as not to notice this. The doctor ought not to be excited and ought to notice. One ought not to cut off clothing that can just as well be removed in the usual way. If its removal causes pain, that is another matter.

When it can be done readily, the patient should be put in a horizontal position. The most stolid appearing person may faint unexpectedly. Many persons are ashamed to choose a horizontal position, consequently the choice should not be offered them. They will lie down readily if they think this makes it easier for the doctor—as it certainly does.

While the instruments are boiling the field of operation, or of the wound, as the case may be, is cleansed as follows: It is washed with soap, a swab of absorbent cotton, and hot water; then with another swab of cotton and a solution of bichlorid of mercury, 1 : 1,000; then it is scrubbed with a swab of cotton wet with alcohol. If the skin is very greasy, a swab wet with turpentine should precede the one wet with alcohol.

The wound, if one exists, or the delicate membranes, such as the lining of the eye, should be irrigated with one per cent saline solution, and foreign material dislodged by gentle washing with cotton.

The vicinity of the operation should then be covered with sterile gauze or with towels wrung out of 1:1,000 bichlorid solution. Another such towel or gauze should be spread on a small table for the instruments, sutures, or dressings. Whenever it is possible to do so, the instruments should be prepared out of sight and hearing of the patient and before he is brought to the operating table. This will avoid delay and the unpleasant suggestions made by the rattling of instruments.

The Operator's Hands.—The operator next prepares his own hands by (*a*) washing them with soap and water, and then with a mixture of washing soda and chlorid of lime, freshly rubbed together with a little water in the palm of the hand, and rinsed off with sterile water or bichlorid solution; or (*b*) he pulls on rubber gloves which have been previously sterilized or which he washes off carefully in the bichlorid solution after he has put them on. The smooth surface of a rubber glove can be quickly freed from germs in this manner, whereas it is a long and tedious process to render sterile the crevices in the skin and about the nails; or (*c*) having washed his hands with soap and water, and having dried them, he keeps them absolutely out of the wound, touching only the handles of the instruments or the ends of sutures and ligatures which will not again pass through the tissues nor remain in the wound. This last method is the quickest of all and with a little practise it is absolutely reliable for the ligation of vessels, suture of traumatic wounds, removal of some foreign bodies, etc. It is not suitable for cases in which the diagnosis is obscure or in which blunt or difficult dissection may be required.

The Instruments and Solutions.—The instruments should be put on to boil during the preparation of the field of operation and the operator's hands. They should be boiled in plain water. Soda is unnecessary unless the water of the locality contains some ingredients which are injurious to metals. Five minutes' boiling is sufficient. The water should then be poured from the pan in which they were boiled, and the instruments may be turned out on a piece of sterile gauze or allowed to lie in the bottom of the pan or tray for use. One scalpel, a curved blunt pointed scissors, plain and mouse toothed forceps, a probe, two small sharp retractors, two or four artery clamps, four small needles, straight and curved, and a hypodermic syringe and needle are instruments

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sufficient for most minor surgical operations. Soda makes them slippery. If handled in accordance with the directions given above they will not rust appreciably. If they are wrapped up in a wet towel and allowed to cool they may become covered with rust in a few minutes.

There should be at hand two basins, one to contain the solution of bichlorid or whatever antiseptic is employed; one to contain the one per cent saline solution. One of these basins may be used for the soap and water with which the patient is prepared.

Local Anesthesia.*—The anesthesia of the operative field is of great importance. The first prick of the needle is or ought to be the only part of many minor operations of which the patient has direct knowledge. Yet this is seldom the case, because the operator is unwilling to wait for the cocain or other anesthetic to take effect, but proceeds with the incision almost immediately. Dilute solutions of cocain, one or at most two per cent, are safer and better in most cases. An exception should be made in the case of small boils in an inelastic skin, for example, of the nose. The additional distention caused by the injection is very painful. Hence the solution should be strong (four per cent), and only a drop or two employed. The solution is best when freshly made. A quarter grain hypodermic tablet of cocain dissolved in twenty-five minims of sterile water makes a one per cent solution.

The method of injection is important. The needle should be small and sharp. If the skin is normal, one naturally makes a small injection at one end of the future incision, either in the skin, or if the skin is thin, beneath it. An injection made into the skin raises a small wheal, possibly half an inch in diameter (Fig. 304, *1* and *2*). Thirty seconds later a second puncture of the needle is made in the far edge of this wheal, and a second injection is made; then a third puncture and injection, and so on. By using a long needle one can inject to a greater distance with one puncture, but this requires a needle of larger caliber. If the injection is made under the skin the resulting swelling is larger and more diffuse—with less distinct edges (Fig. 304, *3*).

Anesthesia should be tested by the point of the needle. The incision should not be made until all feeling of pain has disappeared. If a finger or toe is the subject of operation, circulation should be controlled by a bandage or rubber tube drawn tightly around it; anesthesia will then be complete and more lasting with a smaller amount of cocain.

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* This word should really be analgesia but it is too well known now to be changed.

Cocain is a poisonous drug, especially when injected into the head, though why its effects should be so marked there it is difficult to explain. Many an attack of supposed faintness during a minor operation is really an instance of acute cocain poisoning.

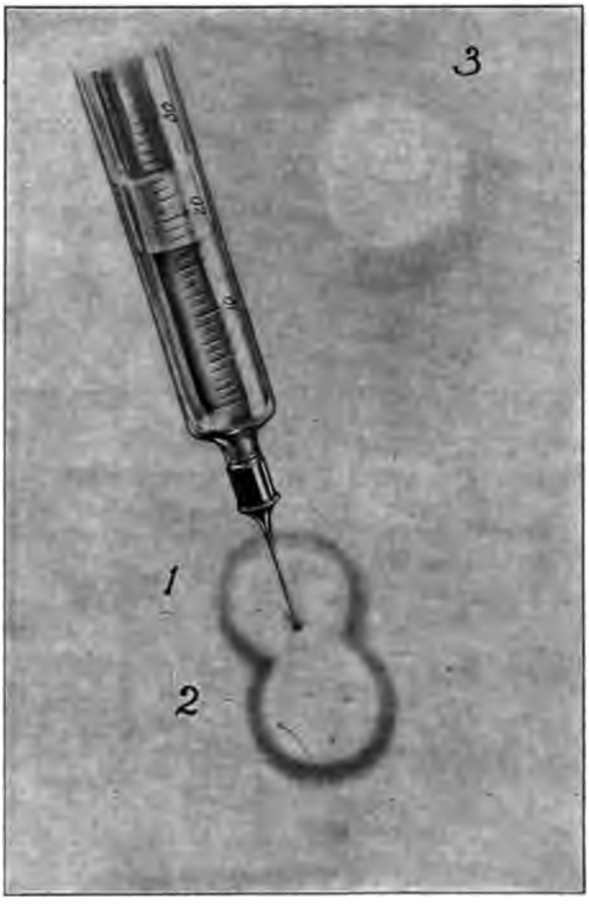

FIG. 304.—INJECTION OF COCAIN FOR LOCAL ANESTHESIA. *1*, the wheal caused by the first injection into (not under) the skin; *2*, the wheal due to the second injection into the skin. The needle for this injection is inserted in the edge of the area already anesthetized. It is shown in the correct position for the second injection. An injection under the skin (subcutaneous strictly speaking) gives a different swelling as shown at *3*.

For this reason the dose should be restricted to one-quarter of a grain if possible.

If an abscess is to be opened, the method of procedure should be slightly different. Injection should be commenced in the relatively normal and elastic skin near one end of the incision to be. From this puncture others should be made, each nearer the center of the skin overlying the abscess. Then, instead of continuing across this much distended portion of the skin, it is better to begin at the opposite margin and again approach the center. In this manner anesthesia is accomplished with the least pain.

Control of Hemorrhage.—Assistance is usually limited or absent, so that the minor surgeon should control hemorrhage promptly by clamp or ligature. One likes to keep catgut out of these wounds, not because the catgut is unsterile, but because there may be a few germs in the wound for which the catgut will be an excellent nutrient medium. Yet if a vessel bleeds freely it had better be tied. A general oozing may be checked by the application of a swab of cotton wet with a solution of adrenalin chlorid, 1 : 5,000.

Tying a Ligature.—Two points are essential to a good method: The operator should have a continuous grasp of both ends of the ligature. That means that he shall never let go of either end until he has secured a fresh hold upon it in another place. The second point follows from the first, namely, that he shall be able to tie the ligature without looking at it. He will then not be delayed if the light is poor or the thread becomes covered with blood. One of the best methods is as follows:

Take a piece of catgut eighteen inches or two feet long. Pass it around the artery clamp, and hold both ends firmly with the middle, ring, and little fingers, leaving the thumb and index fingers free below the threads. The palms are upward (Fig. 305, *1*). Pass the right index-finger over the left string (*2*), and bring it back under the left string, and poke the end of the finger under the right string in the space between the right thumb and middle finger (*3*). Straighten the index-finger, thus bringing a loop of the right string up between the index-finger and the thumb (*4*). Seize this thread between the thumb and index-finger (*5*), and relax the grasp upon it by the other fingers. Withdraw the thumb and index-finger to the right and a crochet stitch has

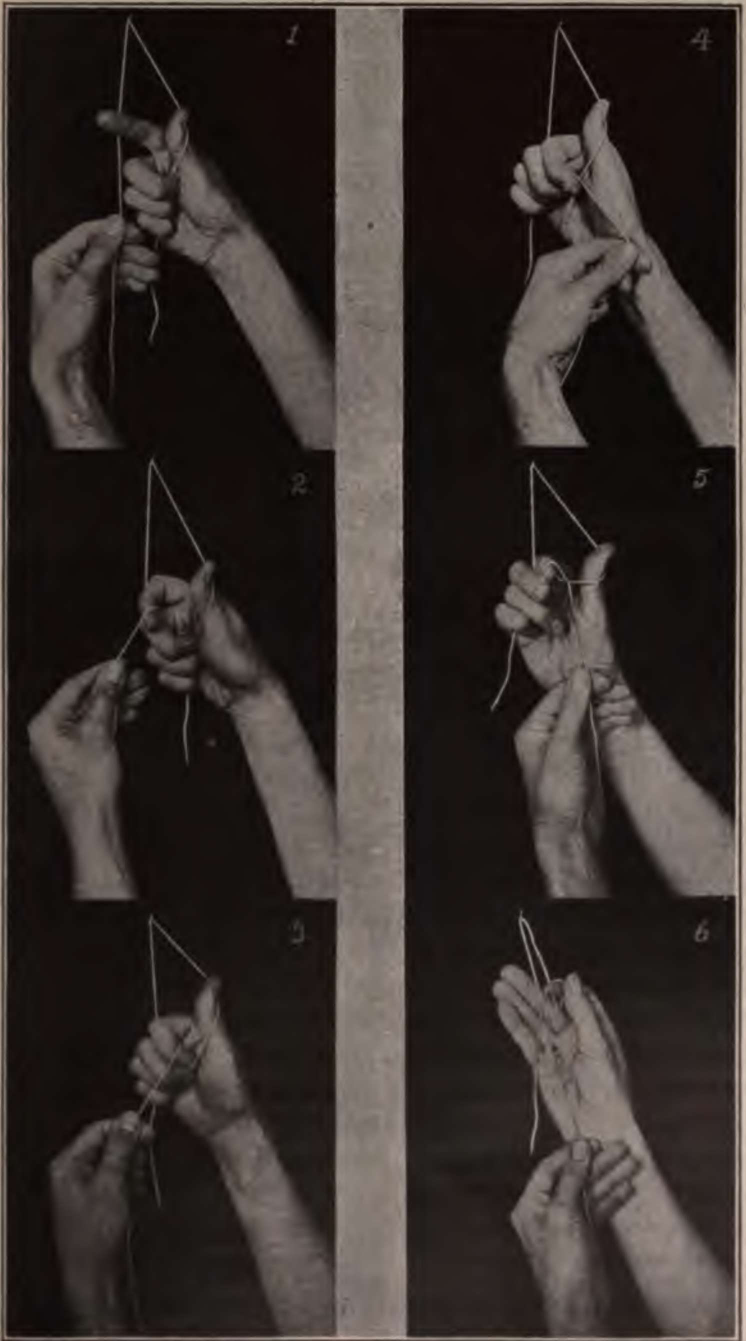

FIG. 305.—METHOD OF TYING LIGATURES. For description see page 568.

been made by the right string upon the left (6). Pull this clear through, and it becomes a half hitch, and can be drawn down tight. A second and a third can be made in the same manner; or if the operator fears a "granny knot," a perfectly groundless fear by the way, the process can be reversed for the second loop, and the right string held taut, while the left forefinger makes the half hitch.

Draining a Wound.—If a wound is almost certainly clean and hemorrhage has been controlled, the skin should be sutured without drainage. Such is or ought to be the case with most of the wounds made by the operator for non-suppurative conditions. It is also the case with many traumatic wounds. A wound should not be condemned because it contains coal-dust, saw-dust, and other kinds of dirt which are incapable of sustaining bacteria pathogenic to man. These foreign bodies can be removed, and even if some particles remain primary union is not impracticable.

If a wound has been made by a butcher's knife, or by a stable fork, or in a machine-shop, where animal fats are used as lubricants, the possibility of suppuration is far greater. In such cases, as well as in ragged wounds and other wounds in which oozing of blood seems probable, a drain should be employed. This drain, while keeping open a way for the escape of fluid, must be so placed and must be of such a character that it is easily removed and leaves a minimum of gaping of the suture line. Usually the wound in such a case should be fully sutured, but the interrupted stitches employed should not be too close, and the drain should be so small as to lie readily between two stitches. A flat strip of gutta-percha tissue, one inch wide and three inches long, twice folded on itself, so that it shall be only one-quarter of an inch long, answers the requirements admirably. It can then be doubled and pushed in by a flat probe (Fig. 306). As the probe is withdrawn it should be rotated to free it from the tissue, which may otherwise stick to it and be pulled out of the wound. A bundle of horsehairs, twisted, tied, and doubled on themselves, makes another good drain. It is stiff enough to insert without a probe. If either of these drains is removed in two days there will be so little additional granulation in its site that the scar is not visibly increased thereby. Hence a small drain should be employed in doubtful cases; for if fluid is allowed to collect in the wound, and has afterward to be evacuated, the resulting scar will be greater than when a drain of this character is employed.

In a third class of cases suppuration exists, and drainage is used to provide for the escape of pus. A great mistake is made in the use of dry gauze in such cases. The very fact that the wound is small and the discharge slight adds to the risk. The pus soaks into the drain, dries on its outside, and seals up the wound with a tough and impervious glue. The abscess cavity is reestablished, the bacteria flourish, and the patient suffers. Over and over again I have seen patients so treated come back with a more extensive cellulitis than when the abscess was first opened. For a few hours they had relief due to the evacuation of the pus, then drainage ceased and symptoms recurred. It

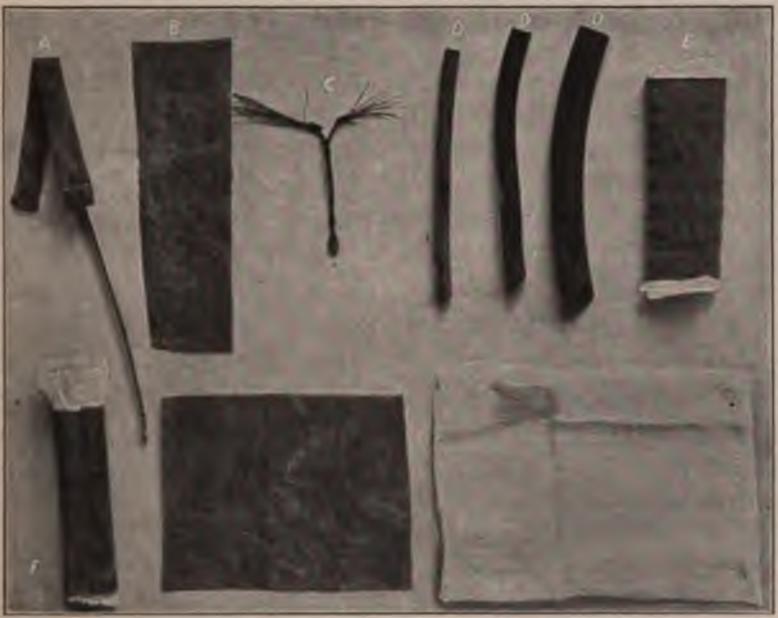

FIG. 306.—DRAINS FOR CLEAN AND SUPPURATING WOUNDS. *A*, Flat gutta-percha drain folded on a probe ready for insertion; *B*, a piece of gutta-percha tissue of the same size as *A*; *C*, horsehair drain; *D*, soft rubber tubes of various sizes; *E*, cigarette drain of gauze in a rubber finger cot; *F*, cigarette drain of gauze and gutta-percha tissue. At the right, a piece of gutta-percha tissue and a piece of gauze each the size of those from which the drain, *F*, was made.

makes no difference whether or not the gauze is impregnated with some antiseptic; drainage is a question of physics not of chemistry.

There are two ways to insure perfect drainage in a small suppurating wound: One is to use a material for drainage which will not adhere to the wound, such as gutta-percha or rubber; and the other is to keep the wound moist. A flat gutta-percha drain of appropriate size may be used; or if it is desired to keep the edges of the wound further apart the gutta-percha tissue may be loosely wrapped around a wick of gauze—the so-called "cigarette drain" (Fig. 306). A rubber finger cot, from which the tip has been cut, makes an excellent sheath for the wick of gauze. In a few cases rubber tubes are used as drains, either because a large flow of pus is anticipated, or because it is desirable to maintain an opening of a fixed size. A soft rubber catheter makes a good drain in these cases. Its rounded end facilitates its insertion in subsequent dressings.

Suturing.—The wounds after minor operations are best closed by interrupted stitches or a subcuticular suture. The saving of time by the employment of a continuous suture of the skin has little value compared with the desirability of accurate approximation of the edges of the skin in exposed portions of the body; and this is more easily obtained by one of the methods above mentioned.

The interrupted suture is too well known to need description, but it is not always employed to the best advantage. To obtain a minimum of scar the sutures should not be too tightly drawn; they should be equally deep on both sides of the incision; they should be of very fine thread or horsehair, and they should be removed in two or four days. To say that a stitch is equally deep in both edges of the wound means that the vertical distance from the surface of the skin to the point where the needle entered or emerged from the cut surface is the same on both surfaces of the wound. If this is not the same on both sides, one edge of the skin will lie above the other, and the scar will be proportionately increased.

Fine black sewing silk and horsehair are the ideal materials for interrupted skin sutures. They are cheap, and can be sterilized by boiling with the instruments. To avoid handling, the needles should be threaded before boiling, and secured in a strip of muslin by catching up a thread in three or four places (Fig. 307).

As stated above, the strain upon a suture should be kept at a minimum in order to avoid a scar due to the stitches cutting through the skin; yet there are some instances in which tension is necessary to bring together the edges of a wound. This should be relieved by undermining the skin for some distance, and by distributing the strain through a large number of fine stitches. It is well to know how to insert a suture under such circumstances if no assistant is at hand to prevent the first knot from slipping.

To tie a knot under tension of the tissues, make two half hitches with one end, holding the other taut. While still keeping the second end taut, slide the half hitches down snugly upon the tissue to be tied. They will always remain in place temporarily. Now hold the first end taut, and loop the second end once about it. Slide this half hitch down upon the two already in place. This makes the knot permanent. Neither end can slip on the other, since each makes a loop about the other.

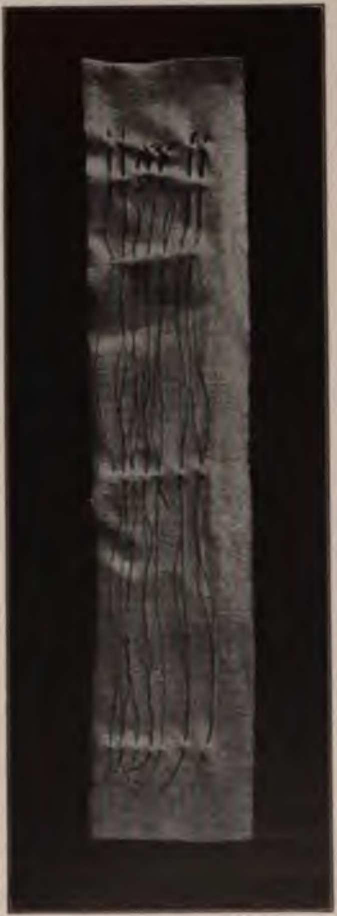

Fig. 307.—Fine Black Silk and Horsehair Threaded in Straight and Curved Skin Needles. The needles at the right with bent points are especially good for subcuticular sutures.

The subcuticular suture is an excellent one for exposed portions of the body, especially when the possible strain on the wound makes it desirable to leave the suture in place more than four days. It should be of strong horsehair or silkworm gut. Both materials can be boiled without injury. The insertion of the suture is much facilitated by the use of a Hagedorn needle with a bent point, as suggested by Dawbarn (Fig. 307, the needles on the right). If one has an assistant he inserts a sharp hook or one prong of the retractor in each end of the wound, and pulls steadily. This fixes the skin edges so that the operator can easily pass the needle into and out of one skin edge and then the other. It makes little difference whether these "bites" of the skin are wholly within the skin (intracuticular) or partly beneath it (subcuticular). They should be placed close together to prevent gaping of the skin. At the beginning and end of the suture, the thread comes to the surface, where it is secured by pinching a split shot upon it. The skin should be slightly puckered along the suture. At the end of five or seven days the suture will be loose in the skin. One shot is then cut off and the suture is pulled out. The shot are not indispensable. A large knot in the suture answers the same purpose, or it may be tied around a bit of gauze.

Minute clawlike metallic hooks are sometimes used upon sensitive patients in place of sutures, to close traumatic wounds.

Dressings for Wounds.—There are three dressings which are especially adapted to use upon small wounds, viz., the dry gauze dressing, the cotton collodion dressing, and the wet dressing.

Dry Gauze Dressing.—This consists of a piece of sterile gauze folded several times so as to have from four to twenty thicknesses. It need not extend more than half an inch beyond the wound in any direction. For a sutured incision it need not be wider than the finger. It is held in place by strips of adhesive plaster, which are so applied that they hold together the edges of the wound and take some of the tension from the sutures. These strips should be separated by a little distance, so that evaporation may not be interfered with. The whole dressing may be bandaged in position, to give greater security.

The dry gauze dressing is suited to sutured wounds, whether traumatic or operative. It should not be applied to raw surfaces nor to suppurative wounds.

Cotton-Collodion Dressing.—This is a convenient form of dressing for very small aseptic wounds, especially when they are so placed that adhesive strips will not adhere, or they or a bandage are unnecessarily disfiguring. This is true of many wounds of the scalp and face. The dressing is applied as follows: All oozing from the wound is stopped. If necessary to accomplish this, a dry gauze dressing and bandage are first applied for a few minutes. A wisp of dry absorbent cotton is then laid across the wound, and the free ends of the fibers are painted from the center with a camel's-hair brush and flexible collodion. When they have been firmly pasted to the skin, the surplus cotton is picked away a few threads at a time, until just enough remains to cover the wound. The free ends of this wisp and both sides are then pasted to the skin by sweeps of the brush from the center outward. If the dressing is too thin or stains through, a second wisp of cotton may be applied over the first. The cotton in contact with the wound should never be saturated with collodion, but should always be dry when applied so that it may absorb a few drops of blood readily, as otherwise these will work their way out to the edge, thereby loosening the dressing.

Wet Dressing.—A wet dressing, for use upon raw and granulating surfaces and over suppurating wounds, consists of a pad of absorbent gauze of suitable size, moistened by some antiseptic solution, and held in place by a gauze bandage. The antiseptic is not for the purpose of killing germs in the wound, but to prevent irritating and foul smelling fermentation in the discharge. Hence it need not be a strong one. Creolin 1:200, or bichlorid 1:5,000, or borolyptol 1:8 are all satisfactory solutions for the purpose. The dressing should be moistened with water every few hours. This is better than covering the dressing with an oiled silk or rubber protective, which macerates the skin unnecessarily.

Other forms of dressing for use upon ulcerating surfaces, etc., are described in the treatment of these special lesions in the earlier chapters of the book.

Opening an Abscess.—In opening an abscess it is important to make the incision through the best point for drainage; to make it of the proper length, neither too long nor too short, and to spare the patient unnecessary pain. In some cases the site and length of the incision can be determined by inspection and palpation. The appearance of the skin often indicates where the pus is trying to work its way to the surface. In other cases palpation will determine this. The center of a large collection of pus near the surface is softer than the indurated periphery, whereas the reverse is true of a small collection of pus in an area of cellulitis.

Then the purulent focus feels more resistant than the surrounding tissues. One can sometimes infer the length of incision necessary from the extent of the swelling. Such an inference is often unreliable, and it is quite unnecessary to depend on it, since the decision can be made more safely as soon as the abscess cavity has been cut into.

The proper method of anesthetizing the skin overlying an abscess has been described on page 566. If the abscess is small, a spray of ethyl chlorid may be used to freeze it. This is less satisfactory than cocain, since the sensation returns so quickly that the patient suffers intensely for a few minutes. Ethyl chlorid used to benumb the site of the first injection of cocain is satisfactory.

When the skin has been anesthetized, a fine pointed scalpel is thrust directly into the abscess. The short incision thus made is then extended in one or both directions, according to the extent of the cavity of the abscess and the importance of the structures which will have to be divided. It is a safe plan to make the incision equal in length to the diameter of the cavity of the abscess. In case of a small abscess it should be a little longer, and in case of a large abscess it need not be so long. It is well to remember that the edematous skin will shrink after the abscess is opened, so that an incision an inch long at the time it is made, may be only half an inch long the next day.

The full length of the incision should be maintained by drains or gauze packing for several days. It is an exhibition of bad judgment to open an abscess by a two inch incision and sew up half of it or allow it to close at once by granulations. It is another matter if one needs the extra cut in order to search for a foreign body or to explore some deep recess—we are here speaking of minor surgery. When granulations form the drain may be rapidly shortened.

As soon as an abscess cavity is opened freely the pus will escape. Squeezing the tissues to hurry it up does no good, and may do harm. Irrigation with saline solution or a very mild antiseptic does not irritate the tissues and will keep the dressing from being at once soaked full of pus.

Removal of a Tumor.—Suppose the skin to have been cleansed and the line of incision rendered painless by injections of a local anesthetic as previously described. If a portion of skin is to be removed, the exact incision should be marked out with a scalpel. After the skin has been cut through retraction takes place, which may make it difficult to determine just how much should be removed. If the incision is linear, this precaution is unnecessary. The knife blade should be in a plane perpendicular to the surface. A beveled incision is not usually desirable. The entire thickness of the skin should be divided throughout the whole line of incision before any attempt is made to reflect the flaps. If the tumor is in the skin, it is next lifted up, and the tissue at its base divided; vessels are ligated, the edges of the skin freed from the deeper tissues for a sufficient distance to permit them to be brought together without undue strain, and the sutures inserted.

This dissection of the flaps is of great importance, since it materially increases the elasticity of the skin.

The shape of the portion of skin that is sacrificed will depend more or less on the shape of the tumor. When circumstances permit, the shape should be elliptical, so that sutures may leave a linear scar. If the area is to be skin-grafted, it makes no difference what shape it is.

If the tumor is beneath the normal skin, so that the latter need not be sacrificed, a linear incision over the center of the tumor is the best to use. Curved incisions often heal with a very prominent scar. After the flaps of skin are dissected free and retracted, the tumor is exposed. Its removal is facilitated if one frees it first on one side and then upon the other. This enables the operator partially to lift it from the wound and so the better to expose the base where the most difficult dissection lies. A cystic tumor should usually be split open before removal (see p. 447).

Skin-Grafting.—The success of skin-grafting depends largely upon the care with which the grafts are handled at the time of operation and subsequently. There are three distinct methods.

Minute grafts may be obtained either by snipping bits out of the skin or by scraping and macerating particles from the outer layers of thick epidermis. They have not generally yielded good results. The little islands of epidermis which they produce will often melt away unless the epidermis growing from the side of the ulcer reaches and surrounds them.

Thiersch Grafts.—Sheets of skin shaved off with a razor, and of sufficient thickness to include the deeper layers of the epidermis and possibly some of the dermis itself (so-called Thiersch grafts) have yielded far better results. The site from which the grafts are taken should be cleansed with soap and hot water and washed with sterile normal salt solution (.8 per cent). The anterior surface of the thigh or the outer side of the upper arm are favorite places from which to take grafts. The skin should be drawn tight and smooth with the fingers or hooks. With a sharp razor, preferably ground flat on its under surface, strips of skin an inch wide and an inch or more in length and of a fairly uniform thickness can be shaved off. The surface to which these are to be applied should be fresh, but should be wiped free from blood. If it is a freshly made wound, hemorrhage should first be controlled by pressure as a blood clot under a graft will absolutely prevent its union. If the surface is a granulating one, the granulations may be shaved off with a razor or simply wiped with sponges wrung out in hot sterile saline solution until the granulations are clean and fresh. Here, too, oozing of blood must be at a standstill before the grafts are applied. As the grafts have a tendency to shrink even though kept moist, it is necessary that they should fully cover the surface. Over them may be laid strips of rubber tissue which are to be covered with compresses constantly kept moist with saline solution, or the tissue may be omitted and the compresses laid directly on the grafts. In either case light pressure should be maintained by a bandage in order to insure a continuous application of the grafts to the underlying surface. Some surgeons do not apply any dressing whatever for several hours, so that the drying of the serum shall firmly attach the graft to the underlying granulations. After that a dressing of dry or moist gauze or rubber tissue is applied.

The subsequent treatment varies. The dressing may be changed daily, great care being observed to keep the grafted area constantly moist and protected from any pressure which would cause the graft to slip. Another plan is to change the dressing in three or four days. Still another plan is to cover the grafts with moist or dry gauze, and not to change the dressing for two or three weeks. Some surgeons apply a plaster of Paris bandage to protect the part from injury.

It will be evident in three or four days whether the grafts have become attached, but even those which appear to be loose should not be too hastily removed, since their deeper portions may have united with the underlying granulations. In a week or more the grafts and portions of graft which have not attached themselves will have become disintegrated, or will be washed away with the pus.

The new skin obtained by minute or Thiersch grafts will never be the equal of normal skin. It is easily distinguished from the surrounding skin years afterward. It may resemble the surrounding skin under ordinary circumstances, but it does not react in the same way to temperature changes. In this respect Wolfe grafts and plastic operations are superior to Thiersch grafts.

Wolfe Grafts.—The third method of skin-grafting consists in the use of grafts composed of the entire thickness of the skin. In some instances success has followed this method when a graft eight inches long and two and a half wide has been employed. The names of Wolfe and also of Krause have been given to this method of grafting. These large grafts are nourished at first by effusion, and then minute vessels make their way into the grafts, and in some instances communicate with the vessels already existing.

The technique is similar to that employed for applying a Thiersch graft. Asepsis without the use of germicidal solution and the control of hemorrhage by pressure are important points. The grafts should be freed of fat. They may be stitched into position, but this is not absolutely necessary. It is of the utmost importance that the grafts should not be moved for several days. Some operators apply dry sterile gauze, and do not change it for weeks unless there is a purulent discharge. Before attempting to remove the dressing, the part should be soaked for an hour in warm boracic acid solution. Other operators cover the grafts with rubber tissue and moist gauze.

According to the results which have been reported, one may expect success with about three-fourths of the grafts employed. Some of the grafts attach themselves in part, other parts becoming necrotic. Equally good results have been obtained by using the skin of a healthy person who has died from an accident only an hour or so previous.

If a Wolfe graft once becomes united, it is far superior to a Thiersch graft. It has all of the characteristics of normal skin, and prevents in great measure the contraction of the underlying scar tissue. Hence, Wolfe grafts are especially serviceable to cover defects about the joints.

Plastic Operations.—Plastic operations are performed in order to hasten the healing of wounds and to prevent or remove deformities of various kinds. They owe their success to the abundant blood-supply of the skin as well as to its great elasticity. On this account flaps with a comparatively small pedicle, especially if the pedicle is directed toward the artery which supplies the tissue of the flap, will maintain their vitality, while the elasticity of the skin enables the operator to stretch one side of the wound far more than the other without producing a difference in tension which will be noticeable after a few days or weeks. The pedicle of a flap may even be bent at a fairly sharp angle with the assurance that the "kink" in the skin thus formed will probably disappear entirely, or, if a surplus remains, it can readily be removed at a subsequent operation.

Plastic surgery naturally finds its chief field upon the face. To cover a considerable defect in the skin of this region is a problem which has called forth many ingenious operations, all of which are dependent on one or more of the following three methods: By the first method a tongue-shaped flap is turned back over the defect so that it is wrong-side out. This method is especially of use about the nose, where it is desirable to form a nasal cavity lined with epithelium. By the second method flaps of various shapes are rotated about their own pedicles in the plane of the surface of the skin. The third method depends upon the elasticity of the skin. By it an incision is made straight away from the defect for an inch or more. The skin and subcutaneous tissue on one side of the wound is freed from the underlying tissues, and drawn along until it either closes the defect or is stretched as far as seems prudent. If two parallel incisions are made, the intervening skin can be stretched even further. If tension is great a large number of fine sutures are more favorable to vitality than a few, since they divide the strain among them, and no one of them is so likely to shut off circulation or to cut through the skin.

Infection from operations of this character is of rare occurrence. It is practically impossible to make some of these wounds aseptic or to keep them so, but the abundant blood-supply prevents the spread of germs in the living tissues in the great majority of cases. The dressing should be changed not later than the second day, and if any inflammation shows itself about the stitches the wound should be frequently cleansed with a mild antiseptic solution; but enough stitches should be left to keep the flaps in position unless the inflammation assumes a serious character. Even if two or three stitch abscesses occur, it is usually possible to postpone removal of the last of the stitches until the flaps have united so firmly as to assure the success of the operation. The development of erysipelas in the wound is a serious matter, for it is likely to proceed at once to deeper layers; and even if it does not cause the death of the patient, the success of the operation is eliminated.

Lumbar Puncture.—As the usefulness of lumbar puncture, both for purposes of diagnosis and as a means of injecting an anesthetic, has been well established, a description of the technique is advisable. In the first place, one should rid himself of the idea that it is a difficult procedure; it is, on the contrary, very easy. In the lumbar portion of the vertebral column the spinous proc-

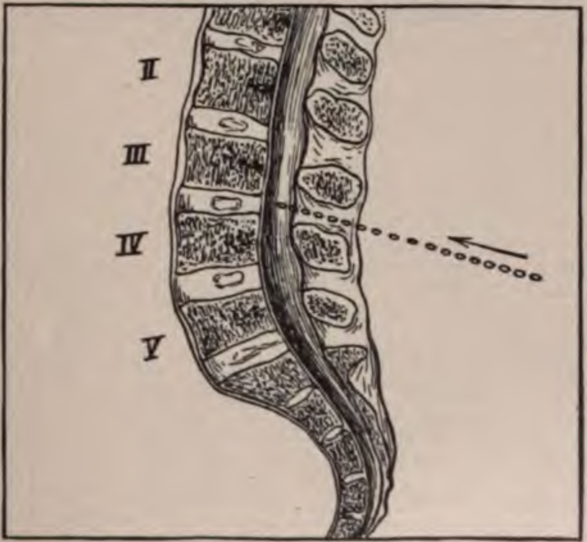

Fig. 308.—Diagrammatic Sagittal Section of the Lumbar Spine, Showing the Necessary Inclination of the Needle for Lumbar Puncture. This figure also shows the thick ligaments which would have to be traversed if the needle were inserted in the median line.

esses project only slightly downward, so that there is a distinct gap between them. This gap is filled with ligaments. To pass a needle into the spinal canal in the median line it would be necessary to force it through about an inch of superspinous and interspinous ligaments (Fig. 308). One avoids this by inserting the

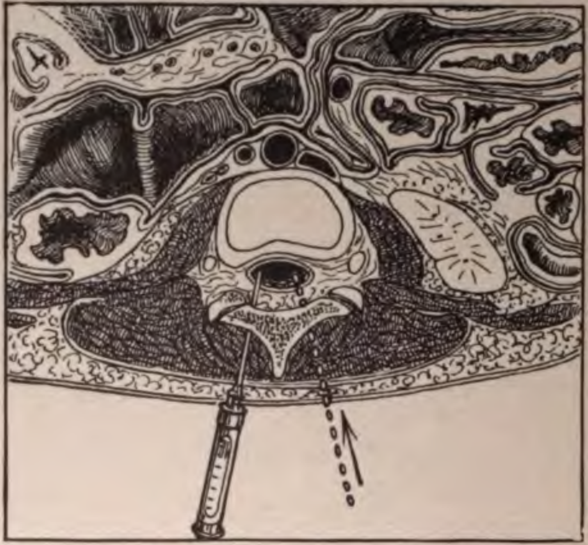

FIG. 309.—TRANSVERSE SECTION OF THE LUMBAR SPINE AT THE LEVEL OF THE THIRD INTERVERTEBRAL DISK, SHOWING THE INSERTION OF THE NEEDLE FOR LUMBAR PUNCTURE. A slightly increased inclination of the needle is better. It should be directed toward the center of the spinal canal.

needle about half an inch to the right or left of the median line (Fig. 309). The needle should then be aimed so that its point will strike the median plane about an inch and a half from the posterior surface. As the lumbar cord does not extend as low down as the bottom of the second lumbar vertebra, there is no risk of puncturing the cord with the needle unless one inserts it above the second lumbar interspace. As a means of obtaining spinal fluid for diagnostic purposes, there is no necessity to go above the third interspace. This is also the usual space selected for lumbar anesthesia.

The technique then is as follows: The patient sits, or lies upon his side, with the lumbar spine well flexed, in order to separate the spinous processes. The third interspace is determined by a palpation. The skin is anesthetized by ethyl chlorid, or the injection of two or three drops of a solution of cocain. It is then punctured with a narrow, sharp-pointed scalpel, one-half inch below and one-half inch to the right or left side of the spinous process of the third lumbar vertebra. This is about on a level with the crest of the ileum (Fig. 310). A small trocar and cannula or a not too sharp aspirating needle is then inserted in a direction slightly inward and upward for a distance of one and a half to two inches. It will either enter the spinal canal or strike bone. If it enters the spinal canal, serum will drop out of the cannula or needle. Only so much should be allowed to escape as is necessary for diagnostic purposes, or as will equal the bulk of the anesthetic to be injected. If cocain is employed, it may be sterilized by dissolving it in ether, evaporating to dryness in a small glass dish, and adding sufficient water to make a two per cent solution. Ten minims of this (one-fifth of a grain) are usually sufficient. It is well to know how much fluid is required to fill the needle, and to make an allowance for this in estimating the amount injected. It takes ten minutes to produce a satisfactory anesthesia, and the

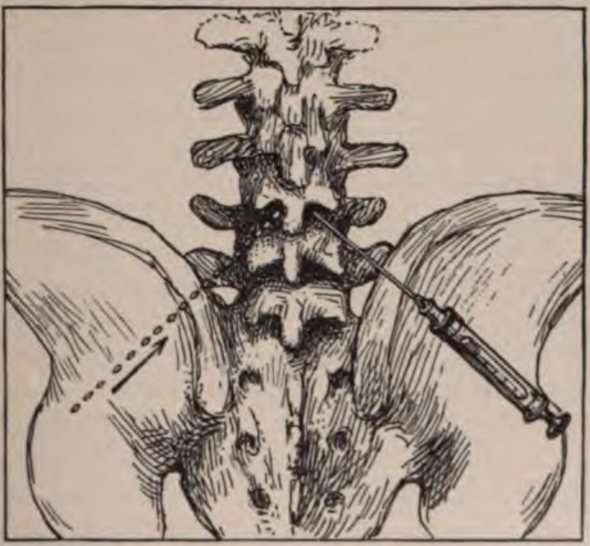

FIG. 310.—THE BONES OF THE LUMBAR SPINE AS SEEN FROM BEHIND. The barrel of syringe as here represented is too far to the right, giving the needle too great an inclination. Compare Figures 308 and 309.

maximum effect is not produced until twice or thrice this period has elapsed. The cannula may be left in place until it is evident that the anesthesia will be satisfactory. Care should be taken that no fluid escapes from it during this waiting period. If necessary, the dose may be repeated in ten or fifteen minutes, and the cannula removed. The wound in the skin is covered with a bit of cotton and collodion.

Stovain (one per cent solution) is by some preferred to cocain. The dose required is about the same.

Transfusion.—This term, which was originally applied to the transfer of blood from an animal or man to another man, is now often employed to denote the intravenous injection of a normal saline solution. Such a solution may be quickly prepared by adding a dram of salt to the pint of boiled water, which should have a temperature of about 100° F. as it enters the body. Hence it should be somewhat warmer than this when placed in the irrigator or fountain syringe. Four feet of rubber tubing, terminating in a fine-pointed glass nozzle or a blunt-pointed hollow needle, are the other essentials of the apparatus.

The vein usually chosen for the injection is the median cephalic vein which crosses the anterior surface of the elbow obliquely from without inward and upward. A light ligature around the middle of the upper arm will make it more prominent. There is, however, no necessity of selecting this vein if another is more readily found. In the condition of acute anemia, which usually exists when intravenous injection is performed, the veins are collapsed and are sometimes found with difficulty. Under such circumstances the position of the vein in the operator's own arm may prove a guide to the median cephalic in the arm of the patient.

The skin is cleansed by wiping it with absorbent cotton wet with alcohol. A transverse incision is made over the vein which has been chosen, dividing the skin only. The exposed vein is seized with dissecting forceps, and the connective tissue is peeled from it for a little distance upward and downward. Two catgut ligatures are then passed around it, but not tied. Tension upon these makes the vein more prominent, so that it is more easily opened. A longitudinal incision is then made and the point of the metal needle or the glass nozzle is inserted in the vein in the direction of the shoulder. The upper ligature is tied in a single knot, thus compressing the vein around the nozzle and preventing the entrance of air and the escape of the saline solution. The lower ligature is tied in a square knot to prevent the escape of blood.

The saline solution is injected slowly, say at the rate of a pint in five minutes. The rate and character of the pulse are the guides to the amount which should be employed. The injection should be kept up until there is a distinct improvement in both the rate and quality of the pulse. If the hemorrhage has been severe, it is usually well to inject at least three pints. When the injection is finished, the tube is withdrawn, the upper ligature tied in a square knot, both ligatures cut short, and the skin sutured.

If it is necessary to repeat the injection, the same vein may be utilized. The wound is reopened, the upper ligature cut, and the nozzle again inserted, and a new ligature applied as before.

Subcutaneous Infusion.—It has been found that saline solution, injected subcutaneously, acts almost as promptly as when it is injected into a vein. The same apparatus is required, excepting that the hollow needle in which the tube terminates should have a sharp point. This is thrust into the loose tissues beneath the breast, or around the scapula, or in the loin or buttock. The difficulty is to make the fluid flow fast enough. It is, therefore, a good plan to connect the tube with two needles by means of a glass Y, and to hasten the absorption by massage in the vicinity of the injection. After half an hour the needle should be shifted to another situation.

Blood-letting, or Venesection.—The withdrawal of blood through an opening made in one of the larger veins is a practise of great antiquity. At times it has been extremely popular, and at times it has fallen into disuse. It is not necessary in this place to discuss the theory of venesection, or blood-letting, but simply to describe a simple aseptic technique for the proper performance of this little operation if it should be considered necessary. The vein usually chosen is the median cephalic vein, which crosses the anterior surface of the elbow-joint obliquely from without inward and upward, and is made prominent by a light ligature around the middle of the upper arm. There is, however, no necessity of choosing this vein, and in some cases it is not the most prominent one in this vicinity. Any well-marked vein of good caliber will suffice.

The skin should be carefully cleansed and strict asepsis observed during the operation.

The vein is exposed and opened by a short incision from above downward. This should divide the skin and the superficial wall of the vein. If one fixes the vessel by pressure with the thumb, a single stroke of the point of the knife will suffice to open the vein. The blood is allowed to escape into a measuring glass. From one to three pints should be removed, according to circumstances. It is useless to withdraw merely a few ounces.

When sufficient blood has been withdrawn the ligature is removed from the upper arm and the flow of blood is stopped by a sterile gauze compress and bandage. Or a single suture may be inserted to close the wound.

Cupping.—This is a means of drawing a small quantity of blood to the surface of the body or of withdrawing it from the body altogether. The former method is spoken of as dry-cupping and the latter as wet-cupping.

To obtain the best results from dry-cupping one should have from six to a dozen small deep glasses, an alcohol lamp or a candle, a pledget of cotton wound around the end of a stick, and a small quantity of alcohol in a cup or other convenient vessel.

The surface of the body where the cups are to be applied is exposed, the cotton swab is wet with alcohol, lighted in the candle flame, and quickly passed to the bottom of an inverted cupping-glass. This heats the glass and the air which is contained in it. The flame is then withdrawn from the glass, and the latter is quickly placed, while still inverted, upon the patient's skin. As the heated and rarefied air contained in the glass cools, a partial vacuum is formed which sucks up the underlying skin and causes the blood to accumulate in it and the sweat to exude from its pores. The maximum effect is produced in a minute or two. Meantime several other cups will have been burned out and applied to the adjoining surface. The glasses used should be thin, so that they will cool quickly if heated. Two ounce whisky glasses, or the deeper glasses which hold three or four ounces, and are often used for mineral waters, answer the purpose admirably.

Wet-cupping is performed in the same manner as dry-cupping, excepting that the skin is first prepared by a number of shallow incisions. These may be made with a scalpel or with a special scarificator. When the cup is applied a dram or more of blood is withdrawn.

Leeching.—The use of leeches to withdraw blood from a bruised or inflamed area is still employed to a certain extent in spite of the fact that infection may be produced in this manner. To reduce this risk the skin where the leech is to be applied should first be cleansed. The leeches should be removed from the water in which they are kept an hour or more before they are needed. They will then attach themselves more readily. It is well to have three or four leeches at hand, because sometimes one will fail to attach itself, and at the most a single leech can withdraw only two or three drams of blood. If warm moist compresses are kept over the part after the leech has dropped off, a little more blood will escape.

Vaccination.—This little operation is often performed with the gravest disregard of surgical principles. The septic infection which not infrequently results is the cause of much of the popular prejudice against vaccination itself.

Now that vaccine material is supplied in surgically clean form direct from the calf, there is no opportunity for the doctor to shift the responsibility for any bad result.

The skin of the arm or leg of the patient should be cleansed by soap and water and alcohol or ether and allowed to dry. It should then be scratched over a minute area—not more than one-eighth inch in diameter—or a very shallow incision may be employed, the instrument, needle or scalpel, having been sterilized in a flame or wiped clean with a cotton swab wet with alcohol or ether. The vaccine should be rubbed in with the same sterile instrument—not with a match or toothpick.

The wound should be covered with a large shield and this with a thin layer of sterile cotton and a gauze bandage. The part should be inspected at least every three days and redressed as often as any serous discharge stains the dressing. This plan of treatment should be continued until the wound is entirely healed, and its importance should be impressed upon the patient and the parent.

For the treatment of ulcer following vaccination see page 432.

CHAPTER XXI

THE ROLLER BANDAGE

GENERAL PRINCIPLES

Preparation of a Bandage.—A roller bandage is a strip of muslin, or other flexible material, which is closely wound upon itself from one end until it forms a roll. This may be done either with the fingers or with a machine called a bandage roller. In rolling a bandage by hand one should be careful to make the first portion rolled very firm, as otherwise it will be impossible to make the whole roll tight, and one cannot apply with satisfaction a bandage which has been loosely rolled.

To roll a bandage by hand take eight inches of one end and fold it over upon itself. Do this the second and the third time. There will result a little mass of bandage about one inch in length. Seize the free edge of this and roll it tightly in upon itself until it becomes encircled by the single thickness of the bandage. Continue in this manner with the thumb and finger-tips until a hard roll of at least one-half inch in diameter is formed. This is then transferred to the left hand and held between the thumb and first and second fingers, very much as a bobbin is held on the sewing-machine. The loose portion of the bandage is passed out between the thumb and first finger of the right hand. By rocking motions of both hands the roll is turned away from the loose bandage and the latter is carried farther around the roll. In this way a very presentable bandage can be rolled in a few minutes.

The bandage can be rolled more tightly and more quickly on a machine such as is shown in Figure 311. One end of the bandage is wrapped around the four-sided bar of the roller until it is caught. One hand then turns the roller while the other keeps the bandage smooth and taut. When the roll is finished, it is grasped firmly and the bar of the machine is turned a short distance in the reverse direction. This loosens the hold of the bandage on the bar, so that the bar can be withdrawn from the bandage.

The materials ordinarily employed for a roller bandage are gauze, muslin, flannel, canton flannel, silk, stockinette, rubber, and crinoline. Each material has its special use (see Chapter XXII).

Every roller bandage has two ends. The end which is free when a bandage is rolled up is called the initial extremity; the other end, which is in the center of the bandage as it is rolled up, and is therefore the last part to be applied, is called the terminal extremity. The two surfaces of the bandage are spoken of as external and internal. The external surface is the only one which appears when the bandage is completely rolled up.

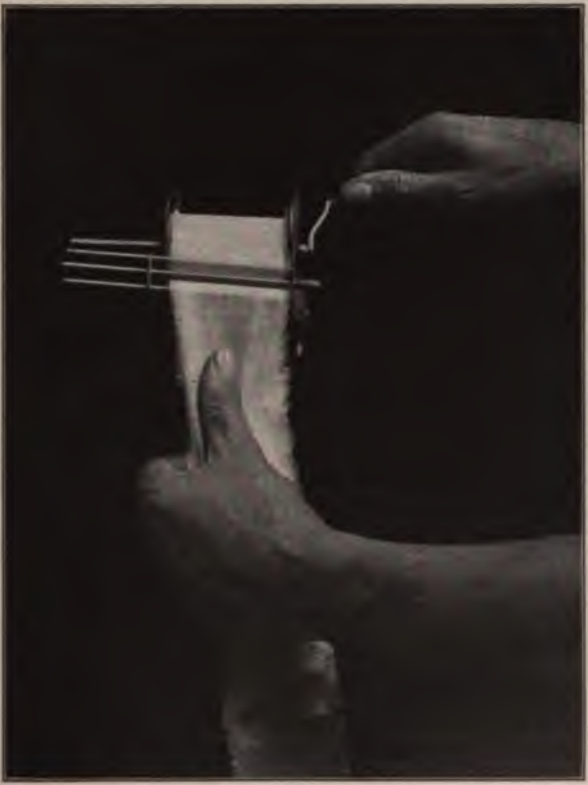

FIG. 311.—ROLLING A BANDAGE ON A SMALL MACHINE.

If a bandage is rolled up from both ends, or if the initial extremities of two bandages are pinned together, the bandage is called a double roller. For the uses of this bandage see Nos. 5 and 8.

Application of a Bandage.—In applying a roller bandage, the external surface should always be placed in contact with the skin. As the bandage is then applied, it will roll away from the limb, and constantly unwind itself; whereas, if the inner surface is applied to the patient, the bandage does not unroll readily, and is likely to be pulled out of the hand of the bandager. Of course when reverses are made, each one changes the surface of the bandage which is directed toward the patient, so that the external surface of the bandage cannot always be directed toward the limb.

Anchoring.—The bandage having been correctly placed, the next step is to fix or anchor it. The bandager with one finger or thumb, or with both digits, holds the initial extremity of the bandage firmly against the part around which the bandage is to be anchored. The other hand carries the bandage around such part and back to the starting-point. As soon as the bandage has completed a little more than the circle, its own pressure will keep it from slipping, and the first hand lets go its hold. The bandage is now continued spirally, being passed from hand to hand as it is carried around the limb. Every person should practise bandaging until he can bandage easily from right to left, or left to right, and cause the bandage to progress toward him or away from him, according to circumstances.

Spiral Reverse.—In applying a spiral bandage from the apex to the base of a cone, the edge of the bandage nearer the apex constantly travels through a smaller spiral than the edge of the bandage nearer the base. If the bandage is inelastic, the edge nearer the apex will always be loose. The limbs of the body, when a person stands erect, are inverted cones; hence the lower edge of a bandage applied to them will always be loose. In stout persons this is more marked than in slender ones. One should never attempt to overcome it by a hard pull upon the bandage. This will cause an undue pressure upon the upper edge of the bandage, which will be pressed into the flesh and will cause a spiral groove in the flesh. This fulness of the lower edge of the bandage is to be overcome by reversing the bandage, or by changing its direction, so that a figure of eight is formed.

To make a reverse in a spiral bandage, the bandager should first select a longitudinal line upon which the reverses are to be made. For the sake of appearance, this is usually the center of the anterior or posterior surface of the limb. When the lower edge of the bandage becomes full, its direction should be changed, until both edges lie equally smooth. While the right hand holds the bandage taut, the left thumb or forefinger is placed on the lower edge of the bandage, about an inch beyond the median line of the limb. The right hand slacks up the bandage beyond this point, and turns it smoothly on itself at such an angle that it will now descend the limb as rapidly as it ascended it before (Fig. 312). When this is accomplished, the right hand again pulls the bandage taut, and the left hand is removed.

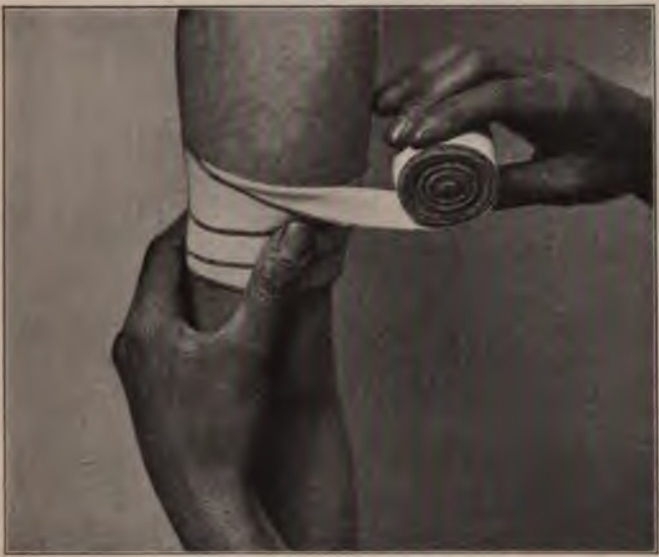

FIG. 312.—MAKING A REVERSE IN A SPIRAL BANDAGE. The left hand holds the bandage, while the right reverses it. The angle made should be such that the ascending and descending portions correspond in direction.

Each time the bandage passes the median line of the limb, the bandage is again reversed, until the conical portion of the limb has been covered.

Overlapping of the Turns.—The distance between the turns of bandage in a simple spiral or a spiral reverse should be equal to one-half or one-third of the width of the bandage. It is obvious that if the progress of each turn is just one-half the width of the bandage there will be a double layer of bandage over the whole surface, and four thicknesses of bandage in the reverses and points of crossing. If the progress of each turn is only one-third of the width of the bandage, there will be three thicknesses of bandage over the whole area covered, and six thicknesses in the reverses and points of crossing. The portion of the bandage where the reverses are made is the firmest part, and the part where the greatest amount of pressure is exerted. If, therefore, a reverse or a figure of eight bandage is applied in order to make pressure upon a wound, it is often desirable to bring the reverses directly over the wounded part, even at the sacrifice of appearance.

Figure of Eight.—The second method of taking up the slack or fulness in the lower edge of a spiral bandage is known as a figure of eight. The direction of the bandage is altered until both edges fit the surface equally. This means that the bandage

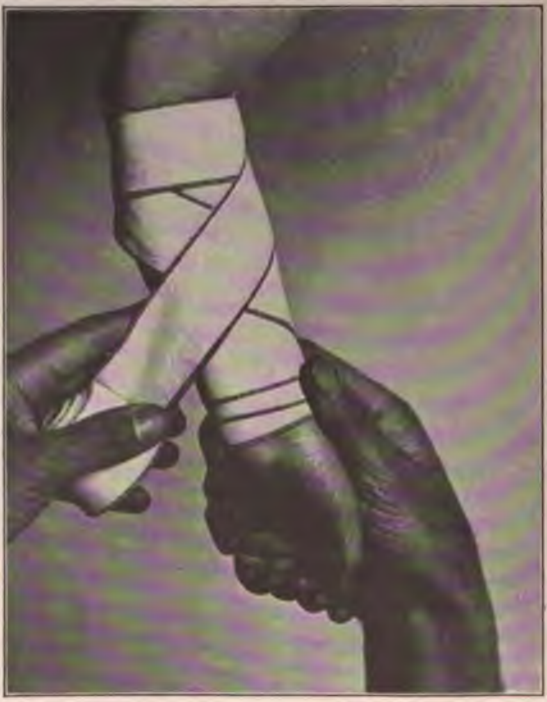

FIG. 313.—MAKING A FIGURE OF EIGHT TURN ABOVE THE GREATEST CIRCUMFERENCE OF THE FOREARM.

is carried sharply upward. It is then carried around the limb, and brought sharply downward, crossing the upward turn at a point a half an inch or more beyond the median line of the limb (Fig. 313).

If the part of the limb utilized for this figure of eight is a perfect cone, the distances traveled by the upper and lower edges of the bandage are not equalized by this maneuver, since what is gained by carrying the bandage sharply upward is lost again by bringing it sharply downward. The practical point is the fact that the fulness is all kept in the upper horizontal portion of the figure of eight where it will be covered by subsequent turns of the bandage.

If the figure of eight is so placed that its lower loop is around an inverted cone, and its upper loop is around an upright cone, then there exists a real equalization of the distances traveled by the upper and lower edges of the bandage, and a considerable amount of fulness is disposed of. This happens in the case of the figure of eight of the leg, provided it reaches above the greatest circumference of the calf; in the figure of eight of the upper part of the forearm; in the figure of eight of the swollen knee, etc.

Where the figure of eight turn leaves the spiral there is a thin spot or even a triangular gap in the bandage. This should be covered in by an additional spiral turn introduced between the first and second figure of eight turns.

The Spica.—The name spica was originally suggested by the resemblance of the crossings in a spiral reverse, or figure of eight bandage to an ear of wheat or barley. It is now generally restricted to such figure of eight bandages as cover a joint between an extremity and the trunk, or between a smaller and a larger portion of an extremity. For instance, the spica of the shoulder (Fig. 362, p. 644) or the spica of the thumb (Fig. 372, p. 652). With this restriction, the name serves a useful purpose, whereas if it were applied indiscriminately to every spiral reverse or figure of eight bandage, it would have comparatively little value.

The Amount of Pressure.—The pressure exerted by a bandage should be uniform. This is best secured by applying the bandage under slight constant tension, and by introducing a reverse or a figure of eight as soon as one edge of the bandage is looser than the other. There is a tendency for beginners to exert too much pressure upon a bandage during its application. As a result, the patient is made uncomfortable, and the circulation is interfered with, so that if the limb has already been injured, areas of necrosis or gangrene may result. One should always note the character of the circulation after applying a bandage to an extremity, and if the tip of the extremity is cyanotic, or the bandage is painful, it should be removed and reapplied. This takes but a few minutes, and may obviate hours of discomfort, or some more serious complication. Whenever a bandage is applied for pressure, it should either be an elastic bandage or it should be placed outside of a layer of elastic material, such as unbleached cotton or lamb's wool. The pressure will then be diffuse, and the risk of injury to the tissues will be minimized.

Completion of the Bandage.—The bandage is usually completed by a circular turn. The end is then stitched or pinned or stuck down with a short piece of adhesive plaster; or the end of the bandage is split, and one-half of it is carried around the limb in the opposite direction, and the two ends are tied together (Fig. 314).

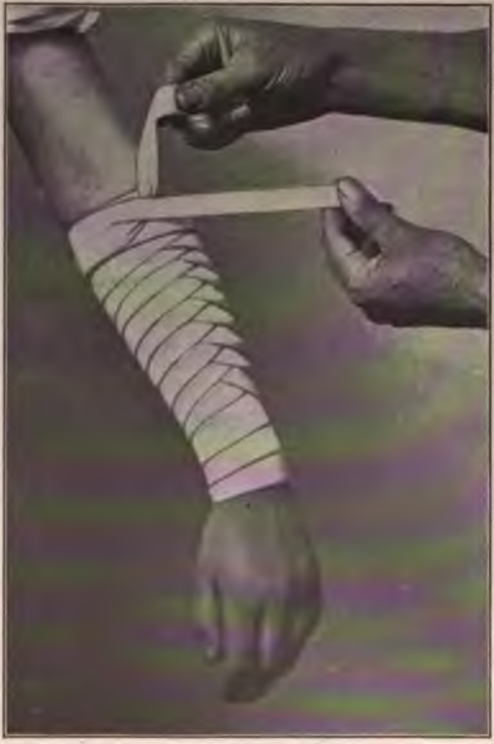

FIG. 314.—FASTENING A BANDAGE BY SPLITTING THE END AND TYING THE HALVES TOGETHER AROUND THE LIMB. The right hand holds the half of the bandage which is to be carried around the limb in the reverse direction. Note that this half of the bandage crosses underneath the other half.

BANDAGES OF THE HEAD

No. 1. Horizontal Circular, or Occipitofrontal; a Two Inch Bandage.—The area covered by this bandage is a circular zone across the forehead, above both ears, and across the occipital region. It is of use to control hemorrhage from scalp wounds, and to fix a dressing anywhere in this area.

The bandage is started on the forehead or occipital region and carried around the head until the occipitofrontal circle is completed (Fig. 315). This anchors the bandage. Several additional turns are then made directly over the first one in front, but slightly above and below it behind, in order to prevent it from slipping. If greater security is desired, as in the case of an alcoholic patient, the single or double oblique circular (Nos. 2 and 3) should be added, and the four intersections stitched or pinned. Greater security is also obtained by giving the bandage a half twist with every half circle or every full circle. This takes up the slack at the edges of the bandage.

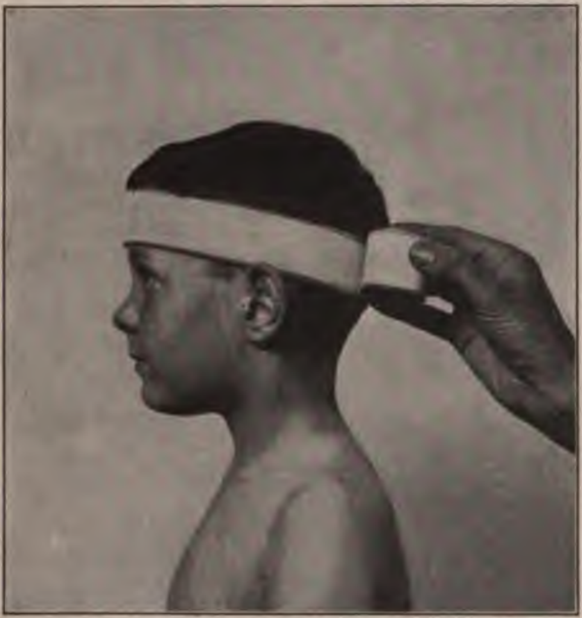

FIG. 315.—OCCIPITOFRONTAL BANDAGE OF THE HEAD, SHOWING ANCHORING.

No. 2. Oblique Circular; a Two Inch Bandage.—The area covered by this bandage is the vertex of the skull, the temporal region and cheek of one side, the under surface of the chin, and the mastoid region of the other side. It is useful in scalp wounds, and to hold a dressing in place either in front of or behind the ear. It is not so firm a bandage as the double oblique circular (No. 3) or the crossed circular (No. 4).

The bandage is started on the vertex of the skull, and carried behind one ear under the chin, in front of the other ear, and back to the starting-point (Fig. 316). This anchors the bandage. Several additional turns are made directly over the first one.

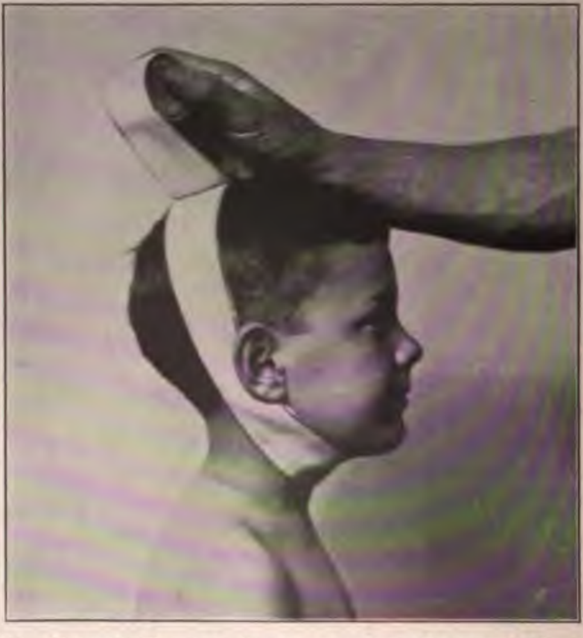

FIG. 316.—OBLIQUE CIRCULAR BANDAGE OF THE HEAD, THE FIRST TURN COMPLETED.

No. 3. Double Oblique Circular; a Two Inch Bandage.—The area covered by this bandage is the vertex of the skull, the temporal and mastoid regions and cheeks of both sides, and the under surface of the chin. It is useful in scalp wounds, and to hold a dressing in place either in front of or behind the ear. It is a firmer bandage than No. 2, and may be made to cover a greater area on the vertex of the skull, since the succeeding turns may overlap a little without slipping.

The bandage is started on the vertex of the skull, and carried behind the left ear, beneath the chin, and in front of the right ear to the starting-point. This anchors the bandage. The second turn follows the first until it reaches the chin, and then ascends behind the right ear to the starting-point (Fig. 317). The third turn passes in front of the left ear, under the chin, and in front of the right ear to the starting-point. A repetition of these three turns will make a firmer bandage, and, if desired, the turns which pass in front of the ears may be carried slightly farther forward without weakening the bandage. This increases the area covered by the bandage on the cheeks, temporal regions, and vertex of the skull.

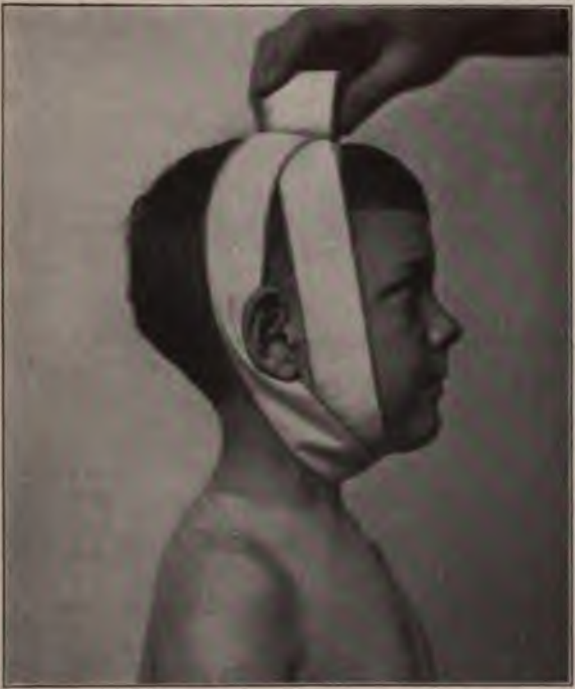

FIG. 317.—DOUBLE OBLIQUE CIRCULAR BANDAGE OF THE HEAD, SHOWING THE COMPLETION OF THE SECOND TURN.

No. 4. Crossed Circular; a Two Inch Bandage.—The area covered by this bandage is that of two intersecting circles, one horizontal and one vertical. The former is the occipitofrontal circle covered by bandage No. 1, and the latter is the circle covered by bandage No. 2. The bandage is chiefly used to control hemorrhage from the vertex of the head, or to maintain a dressing in position on the top of the head, in front of the ear, or at the angle of the jaw. The occipitofrontal circle serves to retain the other in position.

The bandage is started beneath the chin and carried upward in front of the ear on the injured side, across the top of the head, and behind the ear on the opposite side to the starting-point. This anchors the bandage. Subsequent turns may exactly overlie the first, or may overlap it slightly in front or behind. The end of the bandage is fastened with a pin or with adhesive plaster. A circular bandage is next applied from the forehead to the occiput (Fig. 318). When this circle is completed, the intersections of the two circles are sewed or pinned.

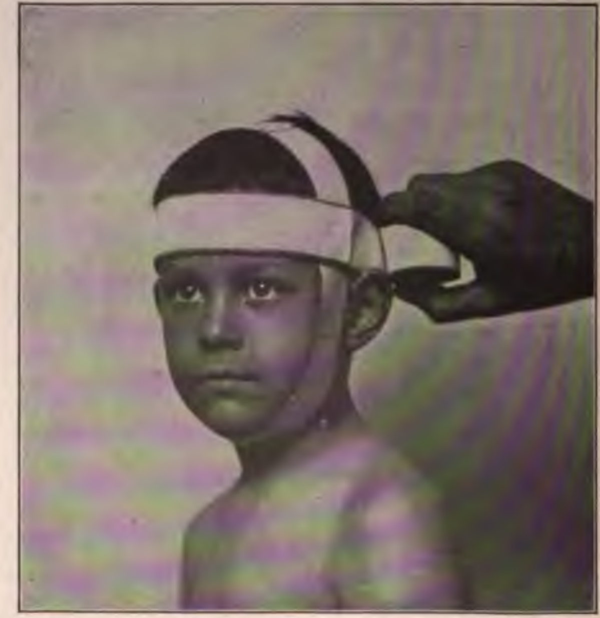

FIG. 318.—THE CROSSED CIRCULAR, ONE OF THE BEST HEAD BANDAGES. The illustration shows the completion of the second circle.

The horizontal circular bandage can be equally well combined with the double oblique circular bandage (No. 3).

No. 5. Knotted Bandage; Two Two Inch Bandages, or a Double Roller.—The area covered by this bandage is composed of two intersecting circles, the occipitofrontal circle and the vertical circle. It is chiefly used to control hemorrhage or make pressure in the temporal region. It may be applied with a double roller or with two single rollers, the initial extremities of which are pinned or stitched together.

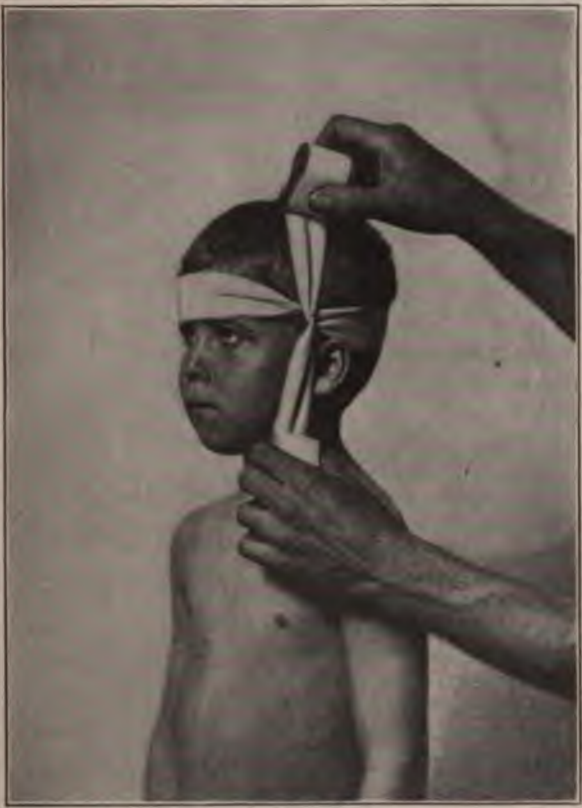

Fig. 319.—Knotted Bandage of the Head, Showing the First Intersection.

The center of the double roller is placed over the right ear, and the two ends are carried horizontally, one across the forehead and the other across the occiput, until they meet in the temporal region of the left side. They are then crossed, and the lower roller is carried upward over the vertex and the upper roller downward under the chin (Fig. 319). When they meet in the right temporal region they are again crossed, the anterior roller being carried around the occiput, and the posterior one across the forehead. By repeating these turns several times, firm pressure will be made in each temporal region. Care should be taken to see that the knots or intersections of the bandage exactly overlie each other.

No. 6. Figure of Eight of Head; a Two Inch Bandage.—The area covered by this bandage is the central portion of the vertex of the skull, both temporal regions, both cheeks, and the under surface of the chin, both parietal regions and the lower part of the occipital region. It is a very firm bandage, especially when combined with the horizontal circular (No. 1), and is serviceable to control hemorrhage or fix a dressing on the vertex of the skull where a very firm pressure is easily made.

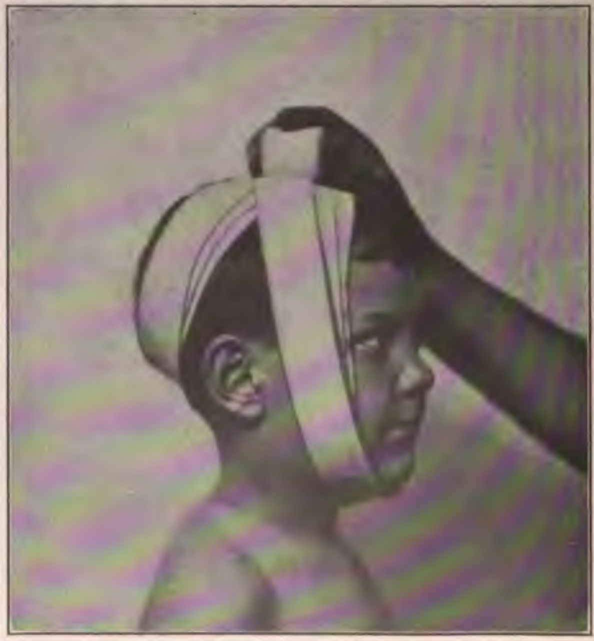

FIG. 320.—FIGURE OF EIGHT BANDAGE OF THE HEAD, SHOWING ANCHORING.

The bandage is started on the vertex, about over the coronal suture, and carried in front of one ear, under the chin, and in front of the other ear to the starting-point. It is then carried under the occiput and back to the starting-point. This anchors the bandage, but two or three additional figure of eight turns are necessary in order to make it solid. The point of intersection of this bandage should be far enough forward to keep the occipital loop from slipping upward. Succeeding turns may overlap each other a little on the vertex, thus increasing the area covered (Fig. 320).

No. 7. Recurrent or Single Roller; a Two Inch Bandage.—The area covered by this bandage is the whole scalp, but it exerts firm pressure only in the occipitofrontal circle covered by bandage No. 1. It is of use to keep a dressing of the scalp in place, but it should not be employed to control hemorrhage from scalp wounds of the vertex, for which purpose bandages No. 4 and No. 6 are better.

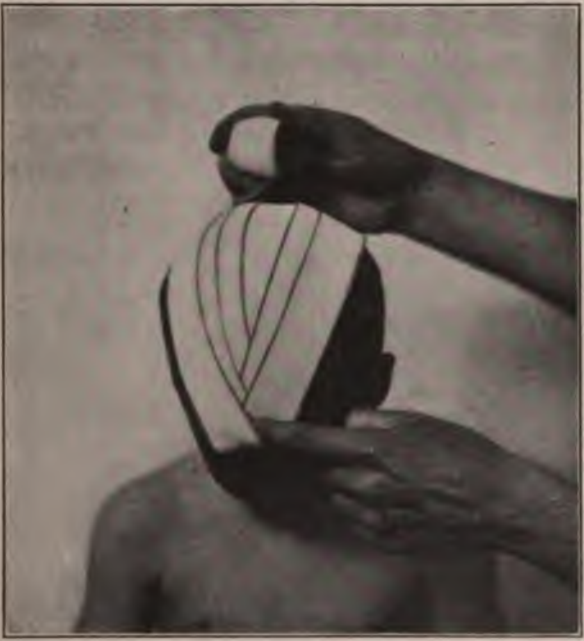

FIG. 321.—SINGLE ROLLER BANDAGE OF THE HEAD. Beginning in the median line the surgeon lays each succeeding turn of the bandage a little farther to the right and left.

The bandage is started on the forehead, and carried directly over the vertex to a point a little below the occiput, reversed and carried back to the starting-point. In making this return the bandage should overlap itself to the right by one-half its width.

It is reversed on the forehead, and carried to the occiput, overlapping itself to the left by one-half its width (Fig. 321). These forward and backward turns are continued, each one a little farther from the median line than the preceding one, until the whole scalp is covered. Two circular turns, without reverses, are then carried across the forehead, above both ears, and across the occiput. These serve to fasten the whole bandage. As this bandage is not anchored until it is completed, it is necessary that either the patient or an assistant hold the loose ends of the reverses on the forehead. The surgeon can hold the loose ends under the occiput until the circular turns of the bandage fix them in position. On account of this drawback in its application, the double roller (No. 8) is usually preferred to the single roller.

This bandage may be applied in two ways: The reverses on the forehead and occiput may all be made in the median line. The various turns of the bandage will then all come to a single point in front, and to a single point behind, like the ribs of a melon (Fig. 322). Another method is to make the forward and

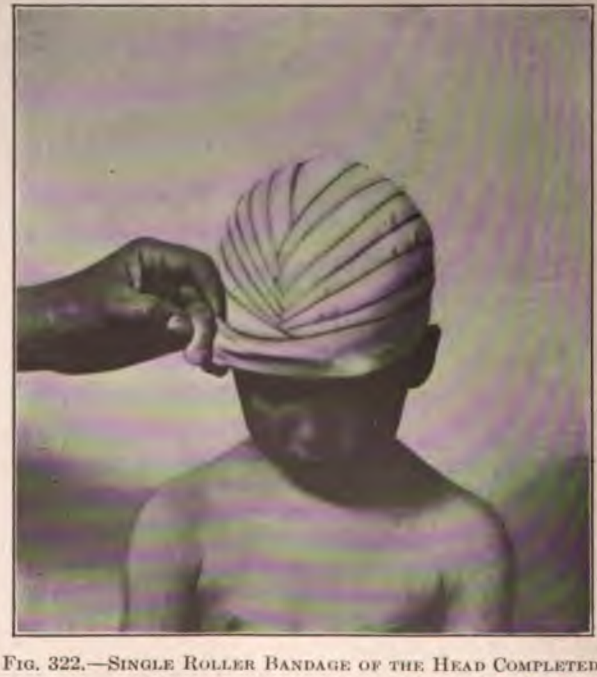

FIG. 322.—SINGLE ROLLER BANDAGE OF THE HEAD COMPLETED.

backward turns more nearly parallel by making each reverse on the forehead and occiput a little farther from the median line. When half of the scalp has been covered, the bandage is carried through the occipitofrontal circle, and brought to the median line. It is there reversed, and by forward and backward turns the other half of the scalp is covered.

Another variation of this bandage is to stop the forward and backward turns when only a part of the scalp has been covered, and then to fix the turns already made by two circular turns. In this manner, for instance, one-half of the vertex of the skull can be covered by the bandage. This variation is seldom employed, since it is apt to loosen and get out of place. The double roller (No. 8) is better than the single roller for this purpose, or one may use the oblique circular (No. 2) or figure of eight (No. 6).

No. 8. Recurrent or Double Roller; a One and One-Half Inch Bandage and a Two Inch Bandage.—The area covered by this bandage and the uses for which it is applied are the same as those of the single roller bandage (No. 7). Although it is somewhat firmer than the latter, it should not be used to control hemorrhage on the vertex. It has a distinct advantage over the single roller in that it can be applied by one person without assistance.

The one and one-half inch bandage is started on the forehead and carried horizontally around the head. This anchors the bandage. A second turn is made directly over the first, but just before the bandage reaches the starting-point the end of the two inch bandage is laid beneath it, so that it may be anchored by the circular turn of the narrower bandage. Without changing hands, the operator carries the wider bandage across the vertex of the skull and down the neck, and carries the circular bandage over it at the occiput. It is now necessary to change each bandage to the other hand. The wider bandage is then carried to the forehead, slightly to the left of the median line, where it is again crossed by the circular bandage, and is then carried back to the occiput, slightly to the right of the median line. Bandages are again changed each to the other hand, and the wider bandage is again brought to the forehead, and crossed by the narrower one (Fig. 323). These forward and backward and circular turns

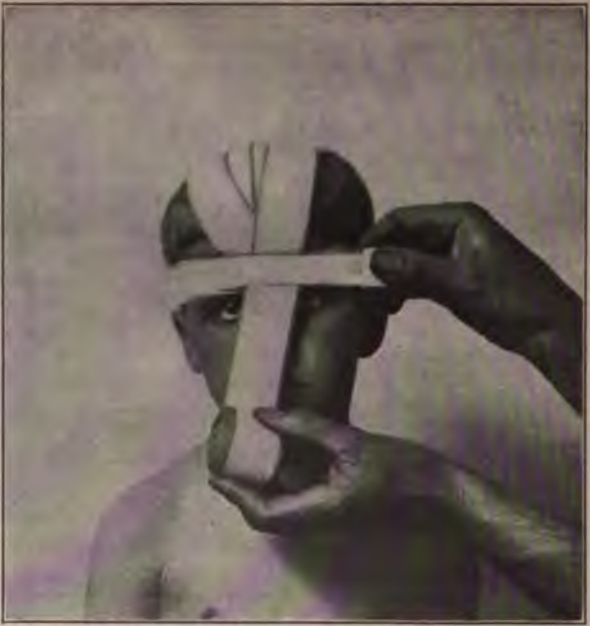

FIG. 323.—DOUBLE ROLLER BANDAGE OF THE HEAD. Each circular turn of the narrower bandage fixes the reverse of the wider one on the forehead and on the occiput.

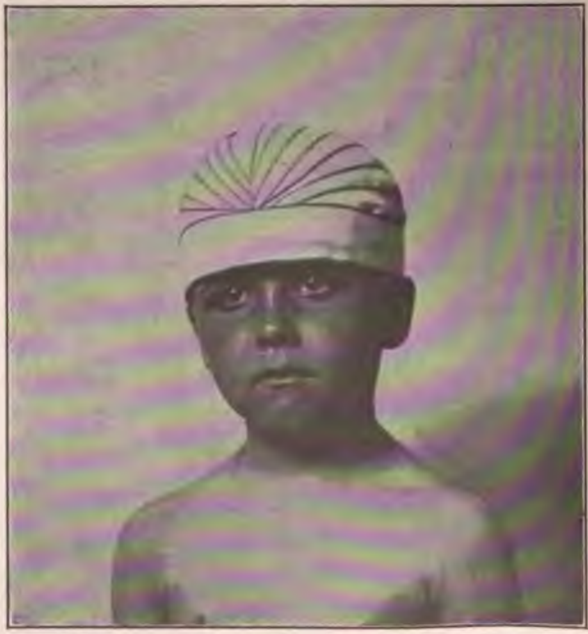

FIG. 324.—DOUBLE ROLLER BANDAGE COMPLETED.

are continued until the head is covered. One of the bandages is then cut off and an additional circular turn of the other bandage (the wider one in the case photographed) fixes the whole in position. The end of this bandage is fastened with adhesive plaster or a safety pin (Fig. 324).

The disadvantage of this bandage consists in the thick band which is formed around the head by so many circular turns. It is to lessen this, and also to make it fit a little better, that the narrower bandage is chosen. The chief advantage of the bandage is the avoidance of turns beneath the chin. These are conspicuous and often uncomfortable, so that patients frequently object to them.

No. 9. Partial Recurrent; a Modification of the Double Roller; Two One and One-Half Inch Bandages.—The area covered by this bandage is the horizontal circle from

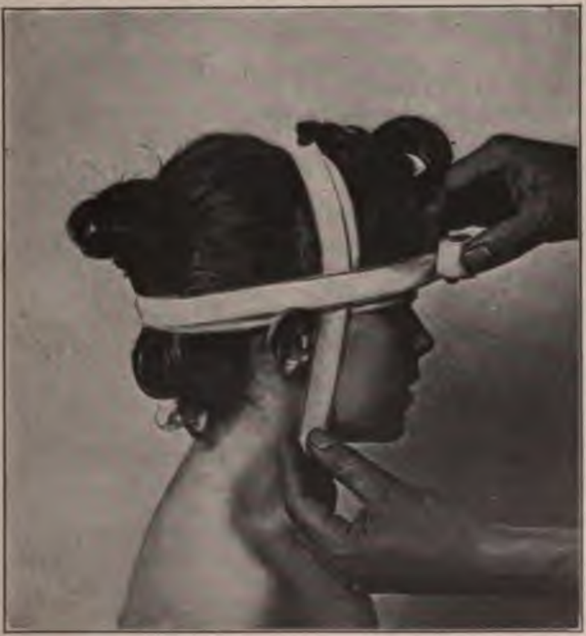

FIG. 325.—PARTIAL RECURRENT BANDAGE OF THE HEAD, SHOWING HOW THE TRANSVERSE TURNS ARE ANCHORED BY THE CIRCULAR TURNS. Note the disposition of the hair.

the forehead to the occiput, and any desired portion of the vertex. Its use is to keep a small dressing on the vertex without covering any portion of the face or neck, while permitting the patient to comb at least a portion of the hair.

One bandage is anchored by carrying it horizontally around the head. The other bandage is caught in the circular turns at the side of the head, and is carried back and forth transversely three or four times (Fig. 325). This gives a fairly firm bandage. It is especially serviceable in the case of a woman whose long hair can be parted transversely at the site of the wound, and brought out in two portions, one in front of and one behind the transverse part of the bandage.

No. 10. Figure of Eight of One Eye; a One and One-half Inch Bandage.—The area covered is the horizontal occipitofrontal circle, and one eye, with a portion of the adjoining cheek. The use of this bandage is to keep a dressing in place over the eye, or to protect the eye from light, etc.

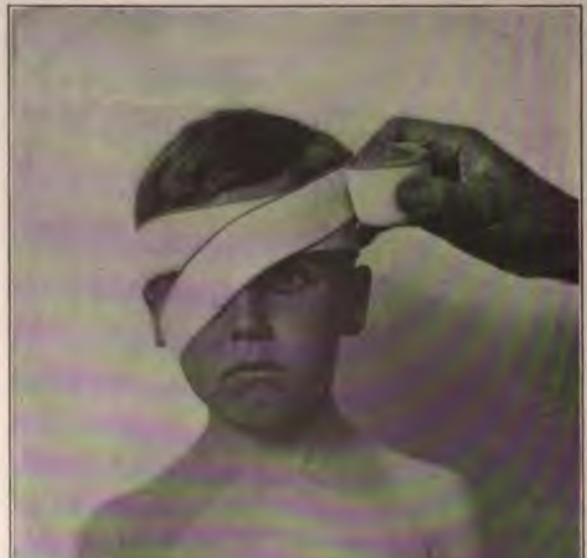

FIG. 326.—FIGURE OF EIGHT BANDAGE OF ONE EYE.

In order to bandage the right eye the bandage is started on the forehead, and carried over the left ear, across the occiput, over the right ear, and to the starting-point. This anchors the bandage. It is then carried over the left ear, across the occiput, under the right ear, across the right cheek, and over the right eye close to the nose (Fig. 326). The second horizontal circular turn is then made directly over the first, and a second oblique turn is made directly over the first oblique turn, until the cheek is reached. Here the bandage should be carried slightly above the first turn, so that on passing the eye the second turn progresses beyond the first by one-third of its width. This may complete the bandage, but usually a third circular turn and a third oblique turn are desirable. To avoid making pressure upon the eye, the oblique turns of this bandage should not be drawn tightly. The patient is usually more comfortable if the oblique turns are not all carried below the ear. It is sometimes a good plan to place a thin fold of gauze or cotton behind the ear and then to allow the oblique turns to pass across the ear instead of below it.

No. 11. Figure of Eight of Both Eyes; a One and One-half Inch Bandage.—The area covered by this bandage is the occipitofrontal circle, both eyes, and a part of both cheeks. The use of this bandage is to keep dressings in place over both eyes or to protect both eyes from the light, etc.

In bandaging one eye the oblique turns pass from the cheek to the eye, each one a little higher than the preceding one, as this gives a better fitting bandage. In bandaging both eyes, it is impossible to do this on both sides of the face. The bandage should therefore encircle the head in such a manner that the oblique turns will ascend over the more seriously injured eye. Suppose this to be the right eye. The bandage is started on the forehead, and carried above the left ear across the occiput, over the right ear, and to the starting-point. This anchors the bandage. It is then carried over the left ear, across the occiput, beneath the right ear, across the right cheek and eye as low down as it is desired that the bandage should extend, and back to the starting-point. It is next carried above the left ear, across the occiput, above the right ear, back to the starting-point, and across the left eye and cheek as low down as it is desired that the bandage should extend. The succeeding oblique turns should be placed a little higher than the first ones. In this manner the bandage is continued until both eyes have been covered. A variation consists in placing a thin pad behind each ear, and carrying the oblique turns directly across the ears, instead of below them (Fig. 327). This varia was followed in the bandage shown in the accompanying il tration.

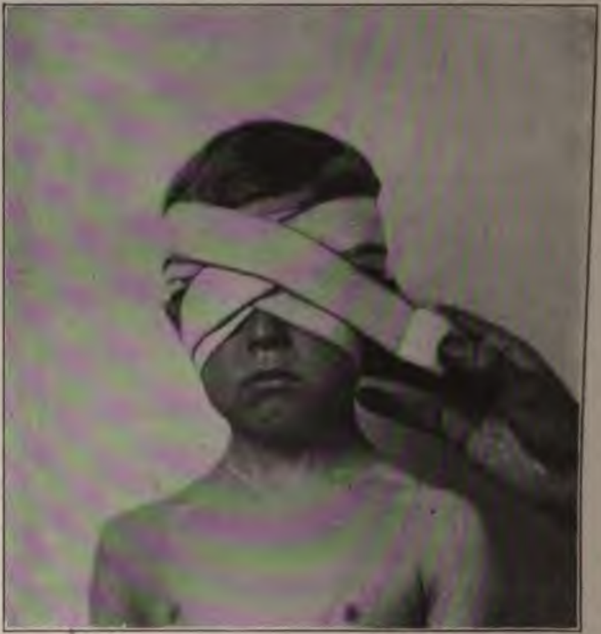

FIG. 327.—FIGURE OF EIGHT BANDAGE OF BOTH EYES. The bandage has been chored, and the second oblique turns over each eye have been applied.

No. 12. Four-tailed Bandage; a Three Inch Bandag Thirty-six Inches Long.—This bandage is employed to ma pressure upward and backward upon the point of the chin. It therefore useful in fracture of the lower jaw. A strip of mus a yard long and three inches wide is split up from each end within five inches of the center. The four ends thus made called "tails." In the center of the bandage a longitudinal is made, or an elliptical piece, two inches in length, is cut (Fig. 8, p. 21). The opening is placed over the point of the chi one-half of the bandage will then rest beneath the chin and other half upon its anterior surface. Those two ends, or "tail of the bandage, which are a continuation of the half of the ban age which is in front of the chin, are carried backward beneath ears, and tied together in a square knot at the occiput. The oth two "tails" of the bandage are carried upward across the chee and tied together in front of the coronal suture. The four ends which have been left long for the purpose are then tied together on the vertex, one pair to the right of the median line and the other pair to the left of the median line. In tying these knots sufficient strain should be put upon the bandage to draw the chin upward and backward.

A simpler plan, though possibly a little less comfortable to the patient, is to tie the pairs of " tails " together in the median line (Fig. 328), or to cut off one " tail " after the frontal knot has been tied, and one " tail " after the occipital knot has been tied, and to tie the two remaining " tails " in the median line.

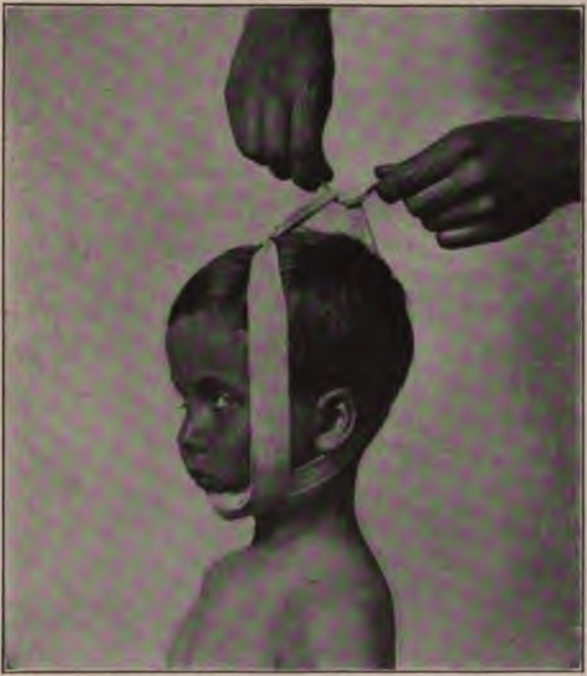

FIG. 328.—THE FOUR-TAILED BANDAGE. Tying the final knot exerts pressure upon the chin, both upward and backward.

No. 13. Barton's; a Two Inch Bandage.—The area covered by this bandage is the central portion of the vertex of the skull, both temporal regions, both cheeks, the under surface of the chin, the front of the chin, both parietal regions, the lower part of the occipital region, and the sides of the neck. Its use is not, however, to control a hemorrhage or maintain a dressing in any of these situations, but to exert pressure upon the chin both upward and backward. It is applied in case of fracture of the lower jaw. It is a combination of the figure of eight of the head (No. 6) and a horizontal turn around the chin and neck.

The bandage is started on the vertex at or in front of the coronal suture, and carried downward behind the left ear, across the back of the neck, forward beneath the right ear, across the chin, and horizontally backward to the occiput. It is then carried upward behind the right ear to the starting-point. From there it is carried downward in front of the left ear, across the cheek, under the chin, and upward in front of the right ear to the starting-point (Fig. 329). The bandage is then carried over the existing turns twice or three times, to give it added security. Intersections of the bandage may be stitched or pinned. This bandage is more complicated than the four-tailed bandage, and presents no points of advantage.

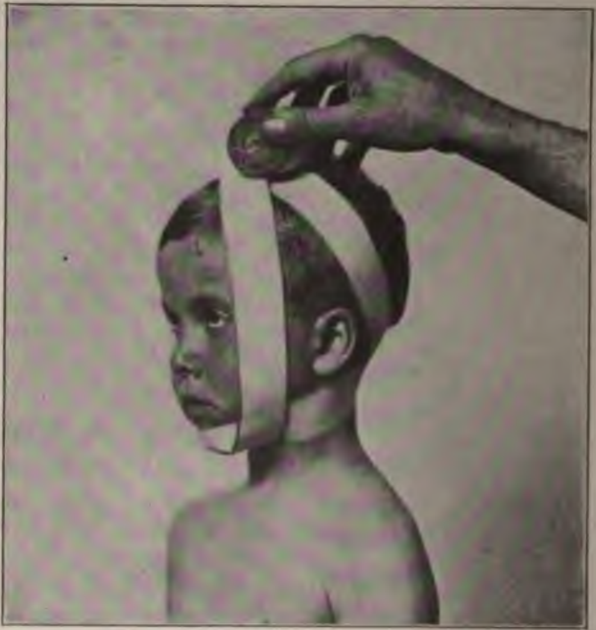

FIG. 329.—BARTON'S BANDAGE, WITH FIRST LAYER COMPLETED. The roller is represented as just starting on the second layer.

No. 14. Gibson's; a Two Inch Bandage.—This is a bandage composed of three circles—a circle from beneath the chin to the vertex of the skull, an occipitofrontal circle, and a horizontal circle from the front of the chin to the back of the neck. It is employed to draw the chin upward and backward in fractures of the lower jaw, but it is less satisfactory than either the four-tailed or the Barton bandage.

The bandage is started at the vertex at or in front of the coronal suture, and is carried in front of the left ear, under the chin, and in front of the right ear and back to the starting-point. Two additional turns are made directly over the first one. A fourth vertical turn is then started, but when it reaches the occipitofrontal circle the bandage is reversed (Fig. 330), and carried three times around this circle. A fourth horizontal turn is started, but when the bandage reaches the occiput, it is carried forward below the right ear, across the front of the chin, and backward below the left ear to the occiput. Two additional turns of this character are applied. When it reaches the occiput, the bandage is reversed

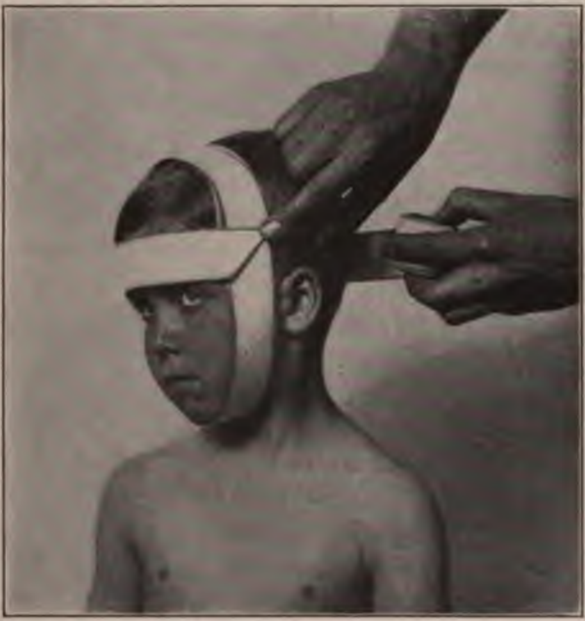

FIG. 330.—GIBSON'S BANDAGE FOR FRACTURE OF THE LOWER JAW, SHOWING THE FIRST REVERSE.

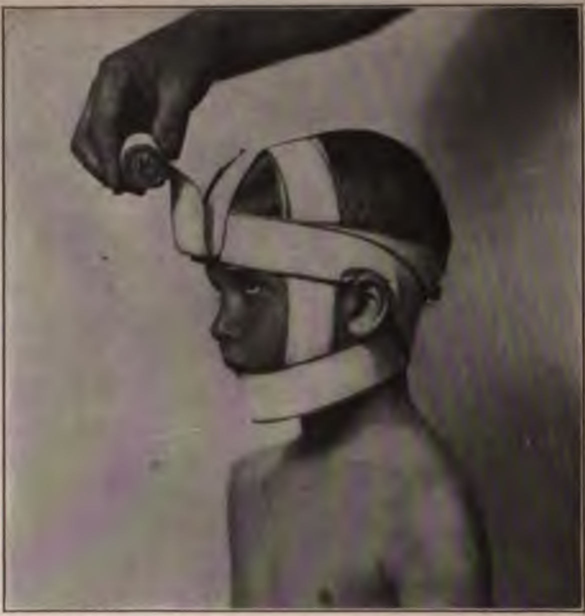

FIG. 331.—GIBSON'S BANDAGE COMPLETE, EXCEPT FOR THE PINNING OF THE INTERSECTIONS.

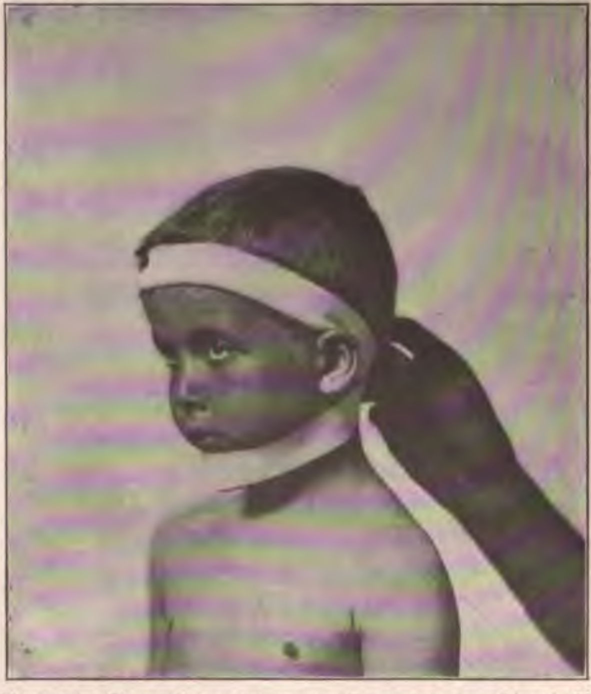

FIG. 332.—FIGURE OF EIGHT BANDAGE OF THE FOREHEAD AND CHIN. The occipitofrontal circle is complete, and the occipitomental circle is nearing completion.

again and carried in the median line over the vertex of the skull to the forehead (Fig. 331). The extremity is there stitched or pinned, as are all the intersections of the bandage—seven in all.

No. 15. Figure of Eight of the Forehead and Chin; a One and One-half Inch Bandage.—The area covered by this bandage is made up of two circles. One is the occipitofrontal circle above the ears and the other the occipitomental circle below the ears. It is of use to control hemorrhage or to keep in place a dressing of the lower occipital region.

The bandage is started on the forehead and carried around the head, above the ears, to the starting-point. This anchors the bandage. It is then carried above one ear to the occiput, and from there describes a circle below both ears and across the point of the chin, and back to the occiput (Fig. 332). From there it describes alternately the frontal and mental circles, each two or three times.

BANDAGES OF THE NECK AND AXILLA, ALONE AND IN COMBINATION

No. 16. Circular of the Neck; a Two Inch Bandage.—The area covered by this bandage is a circle around the neck. It is of use to fix a dressing within this area.

The bandage is started at the back of the neck, and is carried around the neck till the starting-point is reached. This anchors the bandage. Two or three additional turns are applied (Fig. 333) and the bandage is complete.

It is sometimes possible to increase the area covered by this bandage by making of it an ascending or descending spiral. It is usually better under such circumstances to employ the combined head and neck bandage, or the combined bandage of the neck and axilla.

No. 17. Posterior Figure of Eight of Head and Neck; a Two Inch Bandage.—The area covered by this bandage is composed of two circles—the occipitofrontal circle and the circle of the neck.

The bandage is started on the forehead and carried around the head, above both ears, to the starting-point. This anchors the bandage. It is continued in the same circle to the occiput, and is then carried around the neck to the occiput (Fig. 334).

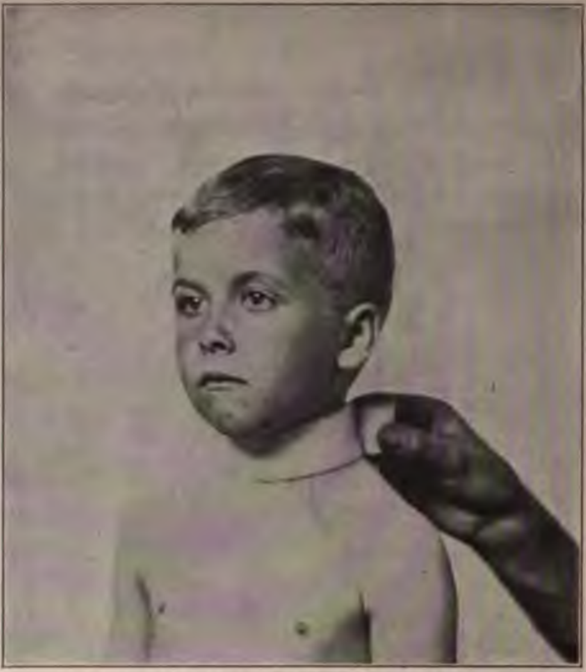

FIG. 333.—CIRCULAR BANDAGE OF NECK.

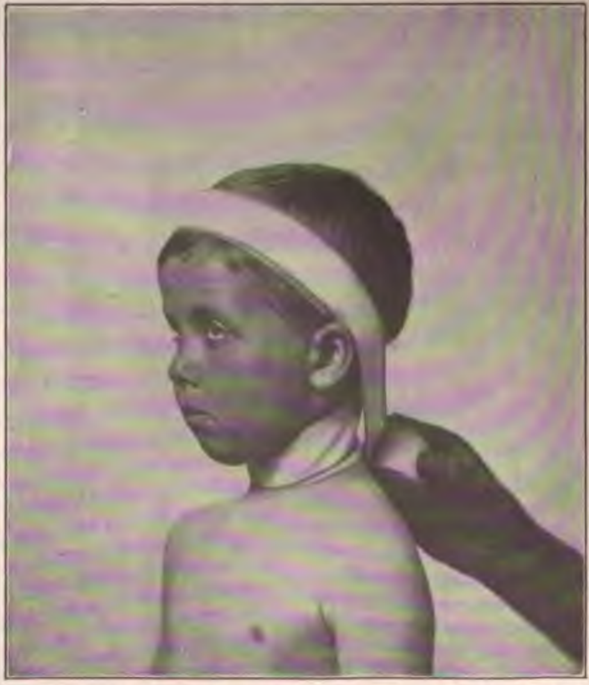

FIG. 334.—POSTERIOR FIGURE OF EIGHT BANDAGE OF HEAD AND NECK. The occipitofrontal turn is completed, and the cervical turn is nearly completed.

These occipitofrontal and cervical turns are continued alternately two or three times. The addition of two or three turns around the neck will carry the bandage farther down the back of the neck, should this be necessary.

No. 18. Anterior Figure of Eight of Head and Neck; a Two Inch Bandage.—The area covered by this bandage is the horizontal circle of the neck, the under surface of the chin, the angle of the jaw, the cheek on one or both sides, the mastoid region on one or both sides, and the vertex of the skull. It is especially useful to keep in place dressings of the front and sides of the neck which extend too high for the circular bandage of the neck.

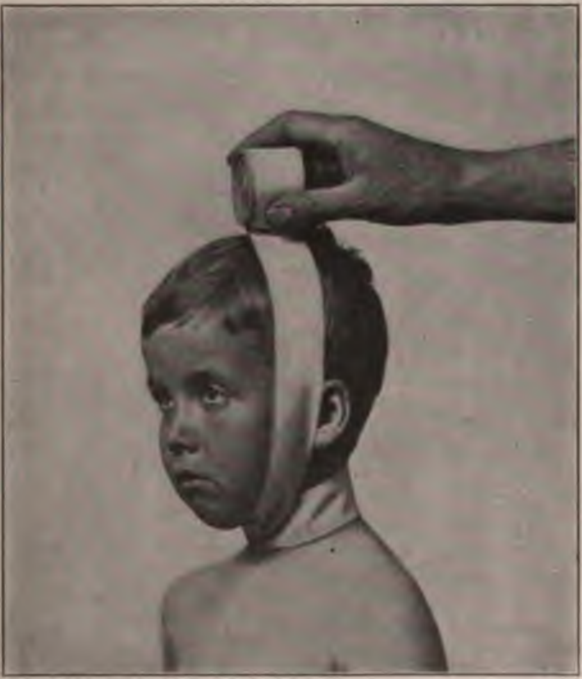

FIG. 335.—ANTERIOR FIGURE OF EIGHT BANDAGE OF THE HEAD AND NECK, SHOWING THE FORMATION OF THE SECOND LOOP.

The bandage is started on the front of the neck and is carried toward the affected side, around the neck to the starting-point. This anchors the bandage. A second circular turn is made slightly above the first. A third turn is started, but when it reaches the side of the neck it is carried over the top of the head, either in front of or behind the ear, according to circumstances (Fig. 335). If it is carried in front of the ear, it must descend behind the opposite ear to the starting-point. If it is carried behind the ear, it may descend either in front of or behind the opposite ear. The fourth turn of the bandage again encircles the neck. The fifth turn is carried over the head. These alternate until the bandage is complete.

This bandage is rendered firmer by the addition of the horizontal circular bandage of the head (No. 1), with pinning or stitching of the intersections.

No. 19. Figure of Eight of Neck and Axilla; a Two Inch Bandage.—The area covered by this bandage is the horizontal circle of the neck, the axilla, and the upper portion of the shoulder. It is useful to keep in place a dressing of the axilla,

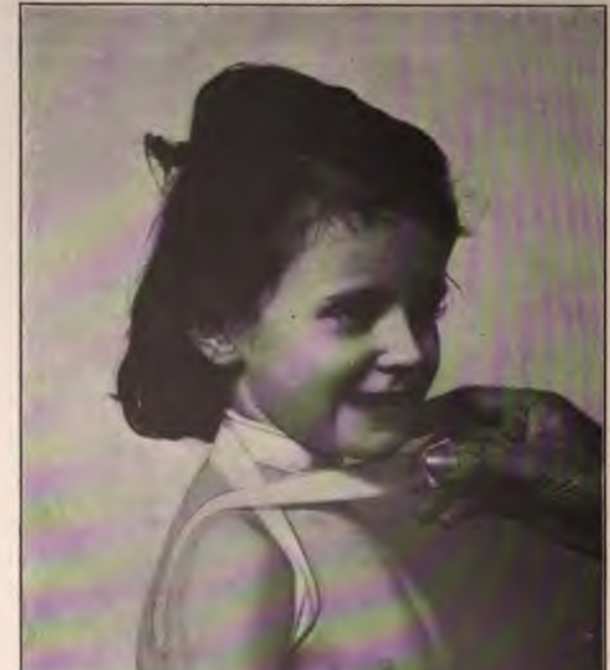

FIG. 336.—FIGURE OF EIGHT BANDAGE OF NECK AND AXILLA. The bandage has been anchored around the neck, and the figure of eight turn is almost complete.

and also to hold a dressing of the neck lower down at the side than is possible with the circular bandage of the neck.

The bandage is started on the front of the neck, and is carried around the neck to the starting-point. This anchors the bandage. A second circular turn is made slightly below the first. A third turn is started, but when it reaches the affected side, it is carried over the shoulder, under the arm, and up over the shoulder to the front of the neck (Fig. 336), and so on around to the starting-point. By repeating this figure of eight turn two or three times it is possible to make the bandage progress a little in one direction or another, so as to increase somewhat the area covered upon the neck and axilla. If it is desired to extend the bandage still farther forward or backward, several simple turns should be made around the neck and under the arm (Fig. 337). If it is desired to extend

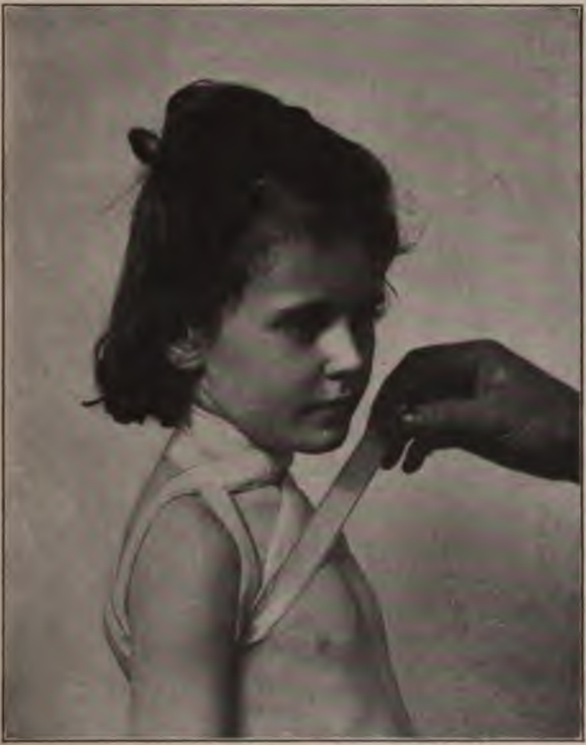

FIG. 337.—FIGURE OF EIGHT BANDAGE OF NECK AND AXILLA, SHOWING THE ADDITION OF SIMPLE TURNS TO INCREASE ITS LATERAL AREA.

the bandage farther down the arm, it should be combined with the descending spica of the shoulder (No. 35). If it is desired to extend the bandage still farther to the front or back, it should be combined with the anterior or posterior figure of eight of the chest, as the case may be. This combination is described under the name "complete bandage of the neck" (No. 22), of which the figure of eight of neck and axilla forms an important part.

No. 20. Figure of Eight of Both Axillæ; a Two Inch Bandage.—The area covered by this bandage is composed of both axillæ and the lower portion of the neck. It is useful in holding a dressing in the axilla, or in keeping an axillary pad in place in cases of fracture of the clavicle or of fracture of the upper end of the humerus.

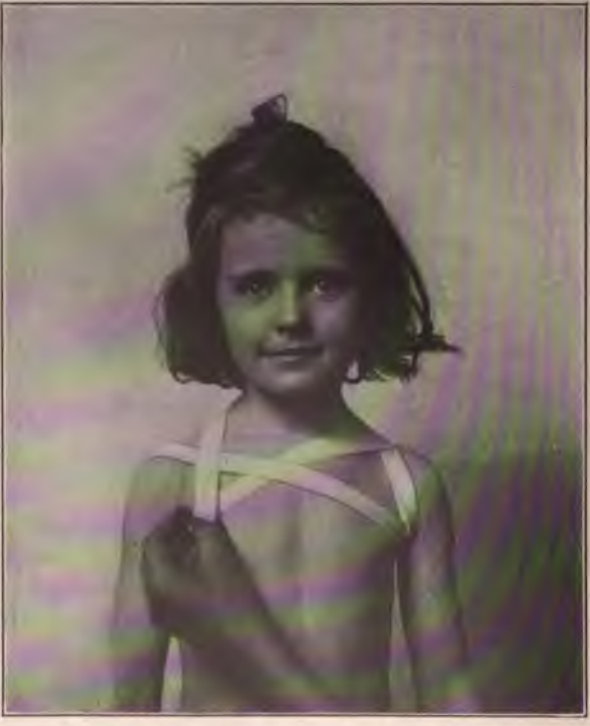

FIG. 338.—FIGURE OF EIGHT BANDAGE OF BOTH AXILLÆ. As shown in the figure, the bandage is almost complete.

The bandage is started at the left side of the neck, close to the shoulder, and is carried across the front of the left shoulder, and backward across the left axilla and to the starting-point. This anchors the bandage. It is next carried across the front of the chest to the right axilla, backward across the right axilla, and over the top of the right shoulder, and across the front of the chest to the left axilla. It is carried across the left axilla, across the back to the top of the right shoulder, over the front of this shoulder (Fig. 338), and across the right axilla, and from there across the back to the starting-point. These various turns may be repeated two or three times. This gives a bandage which leaves the head and neck perfectly free, and which does not interfere with the wearing of a collar.

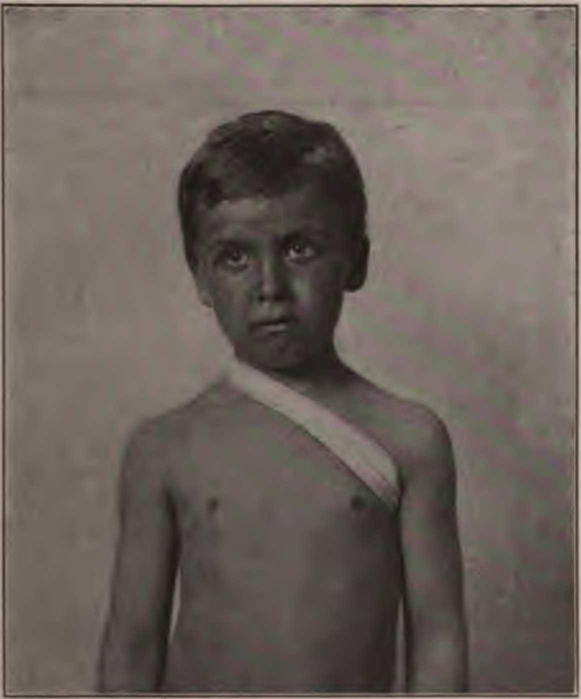

FIG. 339.—OBLIQUE CIRCULAR BANDAGE OF THE NECK AND AXILLA, SHOWING A SLIGHT PROGRESSION UPWARD AND DOWNWARD.

No. 21. Oblique Circular of Neck and Axilla; a Two Inch Bandage.—The area covered by this bandage is the central portion of the axilla. It is useful to hold a dressing in place. If a more extensive bandage of the axilla is required, it will be found in No. 23.

The bandage is started in the axilla, is carried obliquely ward across the back, over the opposite shoulder, and obliqu downward across the chest to the starting-point. This anchors bandage. Additional turns will make the bandage firmer, and tl may be made to progress a little upward and downward in axilla (Fig. 339), but if carried too far they tend to slip tow the center of the axilla.

No. 22. Complete Bandage of the Neck; a T Inch Bandage.—This is a combination of the occipitofront the anterior and posterior figure of eight of the head and neck, circular of the neck, and the figure of eight of the neck and b axillæ (Nos. 1, 16, 17, 18, and 20). If occasion requires, th may be added to these the figure of eight of the chest, both terior and posterior (No. 24).

The area covered by this bandage is the occipitofrontal cir of the head, the back of the head, the circle of the neck, the tops both shoulders and both axillæ, and possibly the upper porti of the chest both front and back. This bandage is used to kee dressing in close apposition to the neck after an extensive dissecti of the same.

The head should be held in correct relation to the trunk. T bandage is started at the forehead, and is carried around the cipitofrontal circle to the starting-point. This anchors the ban age. It is carried the second time around the same circle. third turn is started, but when this reaches the ear it is carri across the occiput to the back of the neck, and is continued arou the neck in the same direction, at least twice, each succeeding tu slightly overlapping the first one, so as to cause the bandage progress from the center downward (Fig. 340). When the ban age next reaches the back of the neck it is carried upward acr the occiput to the starting-point on the forehead. These thr turns—the circle of the head, the figure of eight of the head a neck, and the circle of the neck—are again repeated, or twice, necessary.

The bandage thus far applied serves to fix the head upon t neck, and to hold a dressing at the back of the neck. To compl this fixation and to hold a dressing farther forward on the si of the neck, the anterior figure of eight bandage of the head a neck (No. 17) should be applied. The vertical turns of this ban age should be placed both in front of and behind the ear, at least, on the affected side (Fig. 341).

The next step in the application of this bandage is the fixation of the neck and trunk, and the covering of the lower part of the dressing. This is accomplished as follows: An additional bandage is anchored by starting it at the back of the neck and carrying it once or twice around the neck to the starting-point. The third turn is started, but when it is passed just beyond the top of the right shoulder it is carried under the arm from in front backward, is brought again to the top of the shoulder, and from there to the front of the neck. From there it is carried to the top of the left shoulder, and is passed under that arm from behind forward, and thence to the top of the shoulder and the back of the neck. This part of the bandage, which is a figure of eight of both axillæ, but a variation of bandage No. 20, is repeated three or four times, as

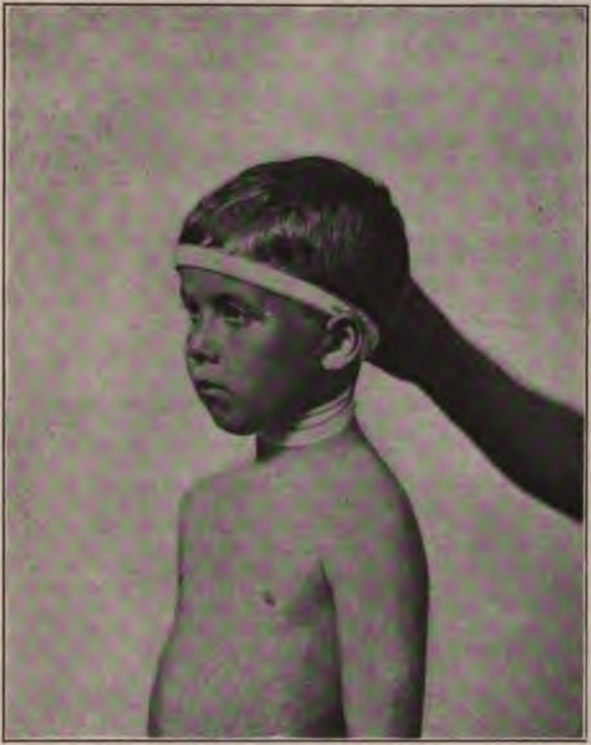

FIG. 340.—COMPLETE BANDAGE OF THE NECK AT AN EARLY STAGE.

may be necessary. The result is shown in skeleton form in Figure 341.

The dressing has now been fixed at both sides; if it requires additional fixation in front and behind, this is to be accomplished by the addition of figure of eight turns of the front and back of the chest. Suppose the bandage to have reached the back of the neck, having just completed the figure of eight of the left axilla (Fig. 341). It is then carried across the back of the shoulders, beneath the right arm to the top of the right shoulder, across the back, beneath the left arm, and above the left shoulder to the starting-point. (Compare Fig. 345.) This figure of eight is repeated two or three times, as may be necessary. The bandage der, and to the front of the neck, under the left arm, from in front backward, over the left shoulder, and to the front of the

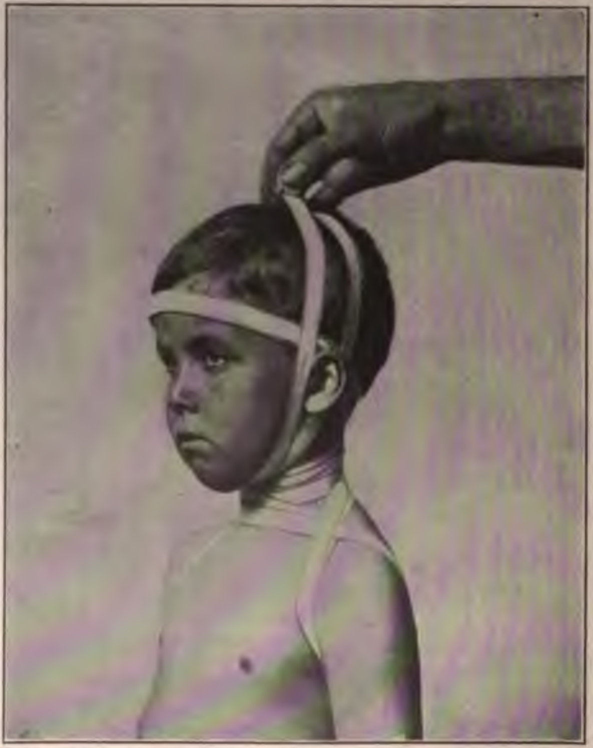

FIG. 341.—COMPLETE BANDAGE OF THE NECK APPLIED IN SKELETON FORM WITH A NARROW BANDAGE TO SHOW THE VARIOUS TURNS.

neck. (Compare Fig. 344.) This figure of eight turn is repeated two or three times, as may be necessary, and the bandage is complete.

If a soft bandage is employed, the intersections on the head should be stitched or pinned. If the bandage which is applied becomes rigid—for example, starch or plaster of Paris—it is a good plan to cut away, after the bandage has become dry, such portions of it as pass beneath the arms crossing in the axillæ. This does not materially lessen the fixation of the head and neck, and it adds greatly to the patient's comfort. If the bandage is a soft one, it may likewise be cut away and fastened to the chest, both in front of and behind each arm, by strips of adhesive plaster.

In many cases it will not be necessary to fix the bandage of the neck to the chest on both sides and in front and behind. It was thought better, however, to describe the full bandage, and to leave to the ingenuity of the physician the omission of a portion of it, according to circumstances.

No. 23. Complete Bandage of the Axilla; a Two Inch Bandage.—The area covered by this bandage is the whole region of the axilla from the inner surface of the arm to the outer surface of the chest. According to circumstances, portions of the bandage may be omitted. It is of use to hold a dressing in the axilla.

This bandage (Fig. 342) is composed of six parts: *A*, the spiral of the arm (No. 36); *B*, the ascending spica of the shoulder (No. 34); *C*, the figure of eight of the neck and axilla (No. 19); *D*, the oblique circular of the neck and axilla (No. 21); *E*, the descending spica (No. 35) of the opposite shoulder, and *F*, the descending spiral of the chest (No. 27).

A. The bandage is started on the arm, near the shoulder, and is carried across the outer surface of the arm from before backward, and anchored by a circular turn. It is then carried spirally upward.

B. As soon as the swelling of the shoulder interferes with the spiral, the bandage is carried over the shoulder, obliquely downward across the back, under the opposite arm, obliquely upward across the chest and over the shoulder and into the axilla. Two or three of these figure of eight turns are applied, each a little higher up on the affected shoulder, while exactly overlapping its predecessor under the opposite arm.

C. The portion of the axilla nearer the chest is next covered in by a figure of eight of the axilla and neck.

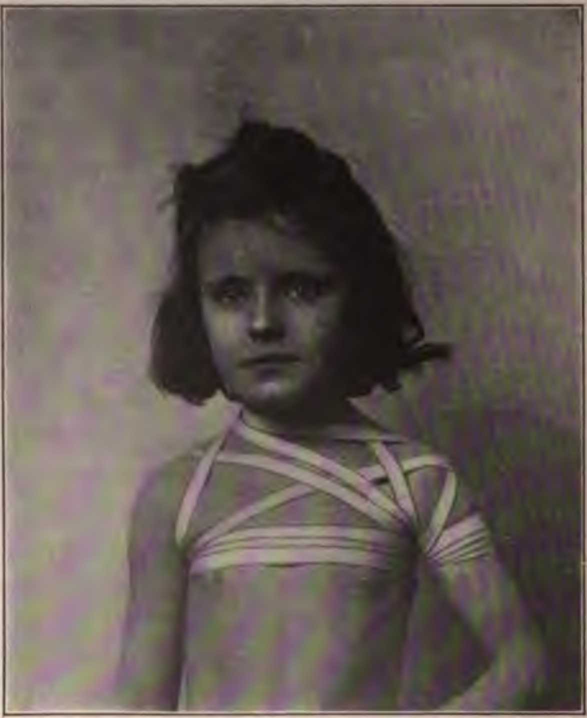

Fig. 342.—Complete Bandage of the Axilla, Composed of Six Parts: *A*, The Spiral of Arm; *B*, The Spica of the Shoulder; *C*, Figure of Eight of the Neck and Axilla; *D*, The Oblique Circular of Neck and Axilla; *E*, The Descending Spica of the Opposite Shoulder; and *F*, The Descending Spiral of the Chest. In the illustration the bandage employed is purposely too narrow, and the area is only partially covered in order that these different parts of the bandage may be the more readily recognized.

D. The portion of the axilla next lower on the chest is then covered by oblique circular turns passing from the axilla obliquely upward across the back to the opposite side of the neck, and obliquely downward across the chest to reach the axilla again.

E. The next lower portion of the axilla is covered by figure of eight turns of the bandage which cross on the opposite shoulder and pass under the opposite arm. This figure of eight is the descending spica of the opposite shoulder.

F. The bandage may be carried still farther downward along the chest by a descending spiral of the chest.

No. 24. Anterior Figure of Eight of Neck and Chest; a Two and One Half Inch Bandage.—The area covered by this bandage is the neck, the front of the chest, and the circle of the chest below the arm. It is a combination of a circular bandage of the neck, a circular bandage of the chest, and a figure of eight connecting the two. The bandage is used to keep a dressing in place on the front of the chest. It has certain advantages over the anterior figure of eight of the chest (No. 25) in that it does not confine the arms.

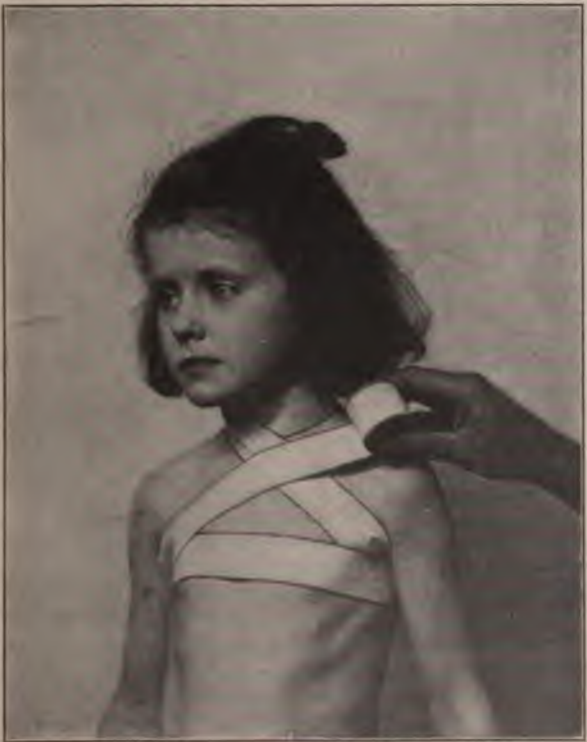

FIG. 343.—ANTERIOR FIGURE OF EIGHT BANDAGE OF THE NECK AND CHEST, SHOWING THE HORIZONTAL TURN OF THE CHEST, AND THE COMPLETION OF THE FIGURE OF EIGHT TURN.

The bandage is started at the front of the neck, and is carried

around the neck in either direction—say to the left as it crosses the front of the neck, then backward to the right, and forward again to the starting-point. The bandage is then carried obliquely across the chest, under the left arm, across the back of the chest, under the right arm, and then horizontally once around the chest beneath both arms. When it reaches the front of the chest it is carried obliquely upward, over the left shoulder (Fig. 343), and so on around the back of the neck to the starting-point. These horizontal and figure of eight turns are repeated three or four times until the bandage is sufficiently firm. It is well to fasten the oblique turns to the horizontal turns around the chest with safety pins, so that they shall not draw up against the anterior axillary folds.

The posterior **figure of eight of the neck and chest is exactly** like the anterior **bandage, excepting that it is started at the back** of the neck and crosses **the back of the chest instead of the front.**

BANDAGES OF THE TRUNK

No. 25. Anterior Figure of Eight of Chest; a Two Inch or a Three Inch Bandage.—The area covered by this bandage is the upper **portion of the front of the chest and two** loops, one around each shoulder. **It is of use to keep a dressing** in place on the front of the chest. **It is also used in combination** with the bandage of the neck to hold in place the **lower part of a** dressing of the neck. It may also be combined with the spiral bandage of the chest.

The bandage is started at the upper end of the sternum and carried over either shoulder, say the right one. It is then carried under the right arm and back to the starting-point. This anchors the bandage. It is then carried over the left shoulder and under the left arm to the starting-point (Fig. 344). This completes the figure of eight. The bandage is carried over this course two or more times. The crossings on the chest may overlap a little to increase the area of the bandage either upward or downward.

No. 26. Posterior Figure of Eight of Chest; a Two Inch or a Three Inch Bandage.—The area covered by this bandage is the upper portion of the back of the chest and the backs and fronts of both shoulders. It is of use to keep a dressing in place on the back of the chest or the back of the shoulder. It may be used in combination with the bandage of the neck (No. 22), to hold in place the lower part of the dressing of the neck. It may also be combined with the spiral bandage of the chest (No. 27). It is sometimes applied in plaster of Paris for fixation of the shoulders after fracture of the clavicle.

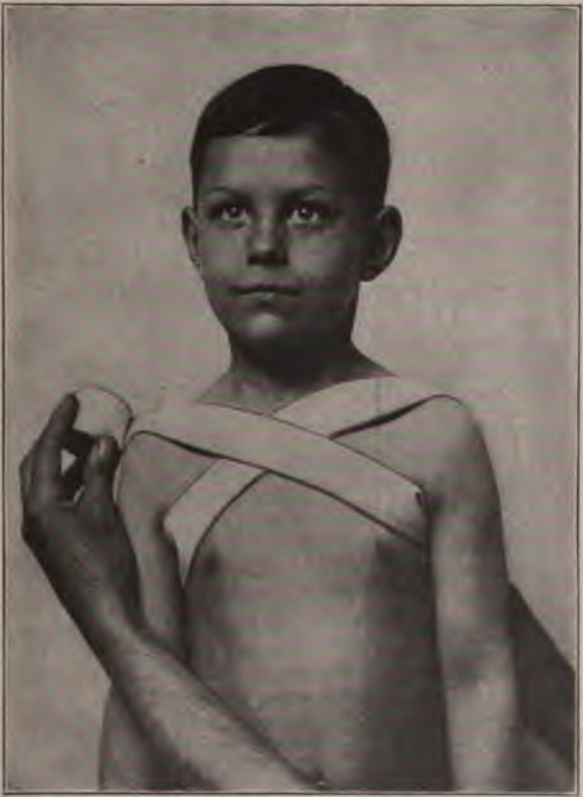

FIG. 344.—ANTERIOR FIGURE OF EIGHT BANDAGE OF CHEST, SHOWING THE COMPLETION OF THE FIGURE OF EIGHT.

The bandage is started at the base of the neck behind and is carried over the right shoulder. It is then carried under the right arm and across the back of the shoulder to the starting-point. This anchors the bandage. It is then carried over the left shoulder, under the left arm, and across the back of the left shoulder to the starting-point (Fig. 345). This completes the figure of eight. Two or three additional figure of eight turns complete the bandage. By overlapping these upon the back one can increase the area covered by the bandage either upward or downward.

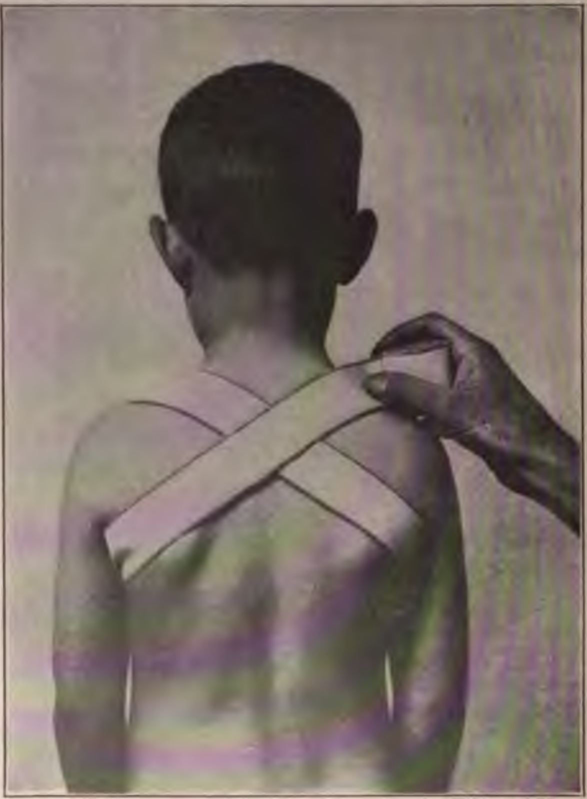

FIG. 345.—POSTERIOR FIGURE OF EIGHT BANDAGE OF CHEST, SHOWING THE COMPLETION OF THE FIGURE OF EIGHT.

No. 27. Descending Spiral of Chest; a Three Inch or Four Inch Bandage.—The area covered by this bandage is the complete area of the chest below the horizontal line which passes under both arms. It is of use to keep a dressing in place anywhere within this region. If it is necessary that the bandage should extend higher the spiral of the chest should be combined with the anterior or posterior figure of eight of the chest, or with both (Nos. 25 and 26). If it is necessary that the bandage should extend lower, the spiral of the chest should be combined with the descending spiral of the abdomen (No. 32).

The spiral of the chest may be an ascending or descending spiral. The latter will be described. The bandage is started a little above the center of the sternum, and is carried horizontally around the chest, just below the arms, to the starting-point. This anchors the bandage. A second turn exactly overlies the first. A third turn overlaps the second at its lower edge sufficiently so that when it is carried around to the sternum it shall be an inch lower down (Fig. 346). The fourth turn is parallel to the third, the fifth to the fourth, and so on until the chest is covered (Fig. 347). The bandage is completed by a circular turn. This bandage is liable to slip downward unless held in place by two shoulder-straps, stitched or pinned to all the turns of the bandage.

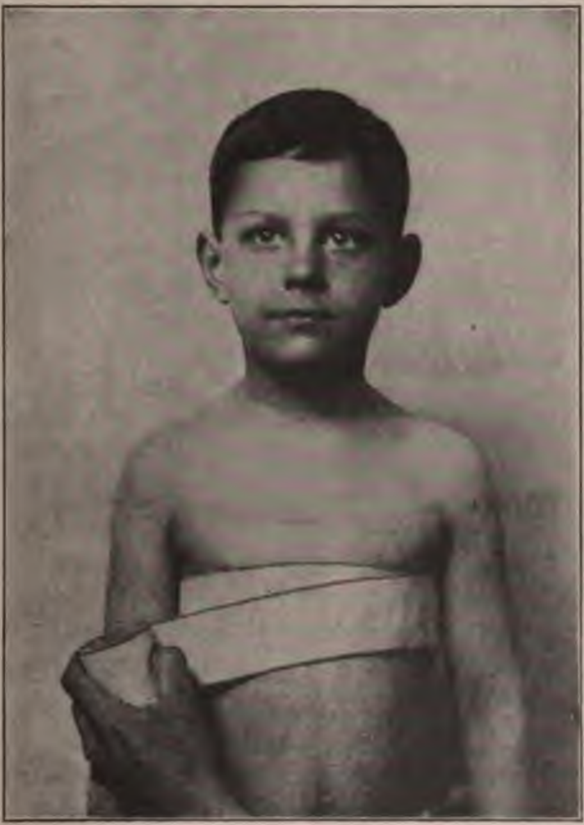

FIG. 346.—DESCENDING SPIRAL BANDAGE OF THE CHEST, SHOWING THE COMPLETION OF THE FIRST SPIRAL TURN.

Ascending Spiral of Chest.—The ascending spiral is similar, excepting that the bandage is started at the epigastrium, anchored by two horizontal turns, and carried spirally upward.

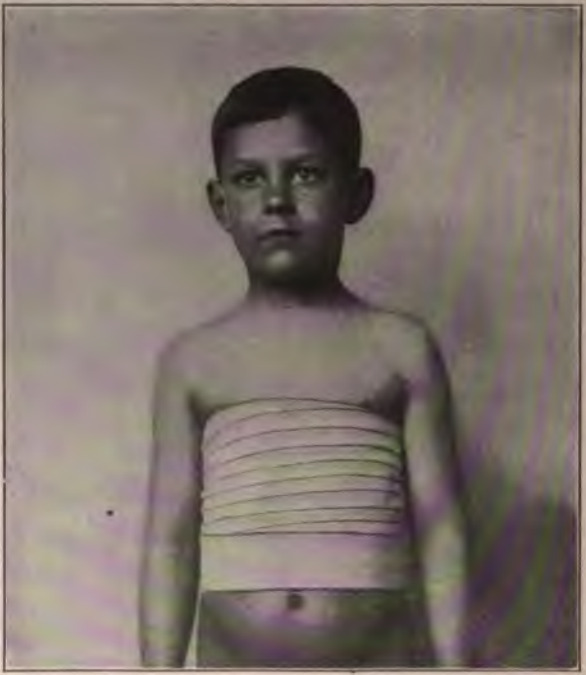

FIG. 347.—DESCENDING SPIRAL BANDAGE OF THE CHEST COMPLETE.

No. 28. Spica of One Breast; a Three Inch Bandage.—The area covered by this bandage is the circle of the lower portion of the chest, one breast, the back of the shoulder on the same side, and the top of the opposite shoulder. It is of use to support and make pressure upon one breast, or to retain a dressing in position.

Supposing the right breast is to be bandaged. The bandage is started over the lower portion of the sternum and carried horizontally across the left side of the chest, the back, the right side of the chest, and to the starting-point. This anchors the bandage. A second turn is carried directly over the first one until the right side of the chest is reached. It is then carried obliquely upward, slightly overlapping the lower margin of the right breast, over the left shoulder (Fig. 348), across the back of the right shoulder, under the right arm, and to the sternum, one inch above the starting-point. It is again carried horizontally around the chest parallel to the previous horizontal turn, and obliquely upward across the breast, an inch above the previous oblique turn. As the bandage passes over the left shoulder this overlapping should be reduced to half an inch or less, as the space here is limited. These alternating horizontal and oblique turns are continued until the breast is both elevated and compressed (Fig. 349). The oblique turns should not be carried very much above the nipple, but the horizontal turns should extend to the upper margin of the breast. A properly applied breast bandage should support the whole weight of the breast, thus relieving all strain upon its

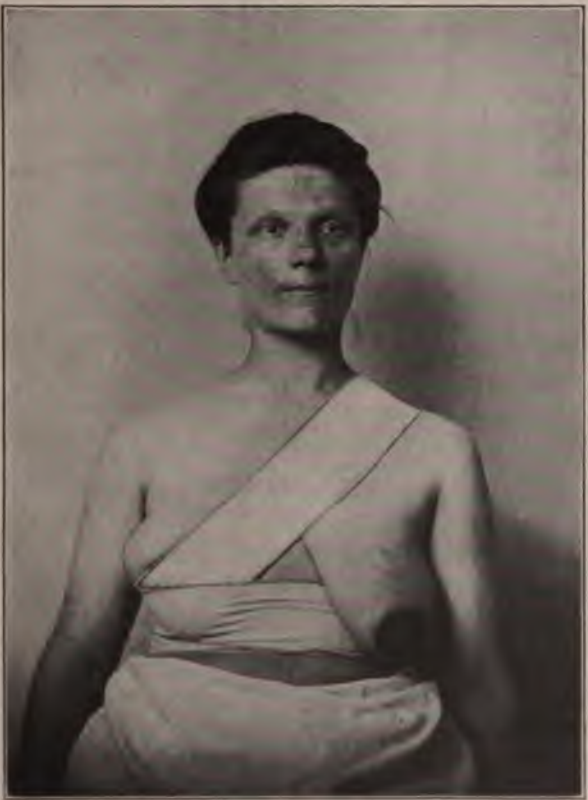

FIG. 348.—SPICA BANDAGE OF ONE BREAST. The bandage is anchored and the first oblique turn is applied.

attachments. If circumstances render it desirable, the nipple c be allowed to protrude between the turns of the bandage, or circular opening may be cut for it after the bandage is complete

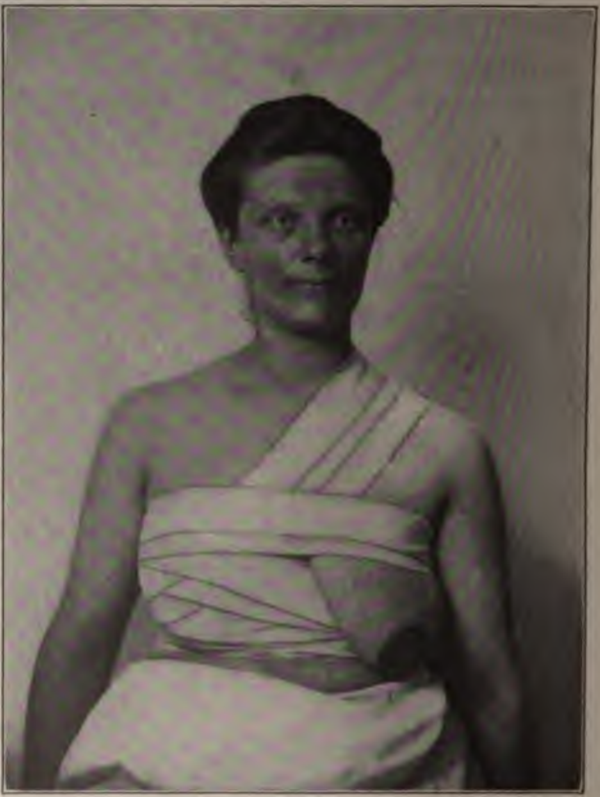

FIG. 349.—SPICA BANDAGE OF ONE BREAST COMPLETED.

No. 29. Spica of Both Breasts; a Three Inch Bandage.—The area covered by this bandage is the circle of the lowe portion of the chest, both breasts, and the backs and tops of bot shoulders. It is of use to support and make pressure upon bot breasts or to retain a dressing in position.

In bandaging one breast, the bandage should invariably b carried from the lower edge of the breast to the opposite shoulder In this way the drag of the bandage is upward, and tends to lif the breast with it. In bandaging both breasts with a single bandage, it is necessary to approach one breast in the opposite direc tion. The latter should, of course, be the breast less affected. In the following description, the left breast is assumed to be more affected than the right.

The bandage is started over the lower portion of the sternum and carried horizontally across the right side of the chest, the back, the left side of the chest, and to the starting-point. This anchors the bandage. A second turn is carried directly over the first one until the left side of the chest is reached. The bandage is then carried obliquely upward, slightly overlapping the lower margin of the left breast, over the right shoulder, across the back of the left shoulder, under the left arm, and to the starting-point. It is then carried horizontally to the right side, across the back over

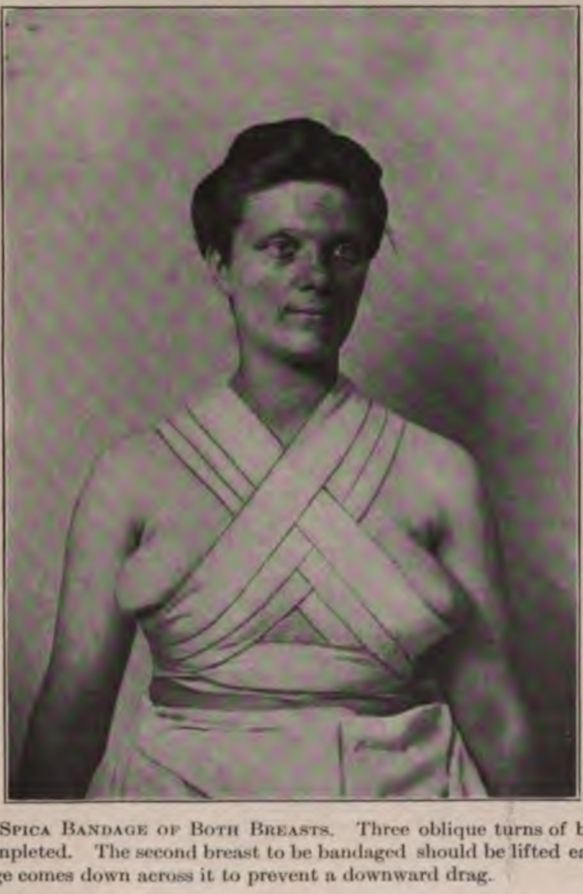

FIG. 350.—SPICA BANDAGE OF BOTH BREASTS. Three oblique turns of both breasts are completed. The second breast to be bandaged should be lifted each time the bandage comes down across it to prevent a downward drag.

attachments. If circumstances render it desirable, the nipple can be allowed to protrude between the turns of the bandage, or a circular opening may be cut for it after the bandage is completed.

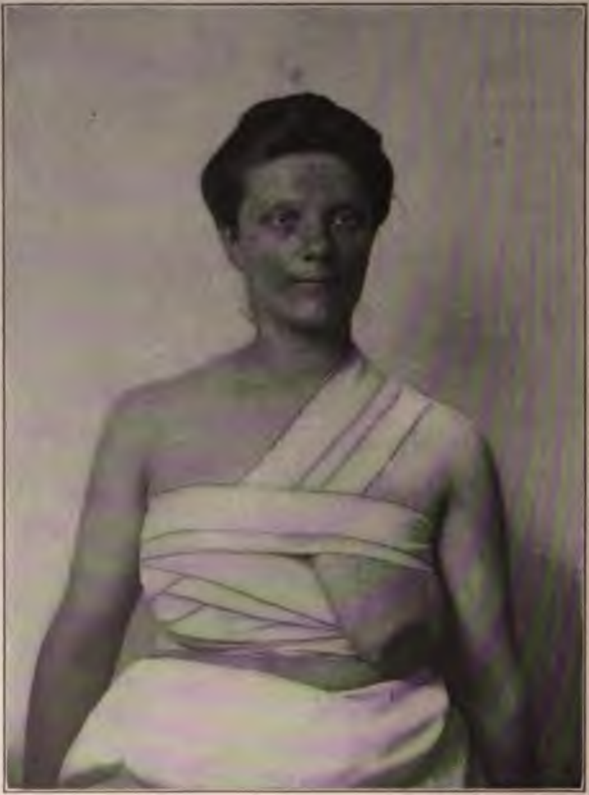

Fig. 349.—Spica Bandage of One Breast Completed.

No. 29. Spica of Both Breasts; a Three Inch Bandage.—The area covered by this bandage is the circle of the lower portion of the chest, both breasts, and the backs and tops of both shoulders. It is of use to support and make pressure upon both breasts or to retain a dressing in position.

In bandaging one breast, the bandage should invariably be carried from the lower edge of the breast to the opposite shoulder. In this way the drag of the bandage is upward, and tends to lift the breast with it. In bandaging both breasts with a single bandage, it is necessary to approach one breast in the opposite direction. The latter should, of course, be the breast less affected. In the following description, the left breast is assumed to be more affected than the right.

The bandage is started over the lower portion of the sternum and carried horizontally across the right side of the chest, the back, the left side of the chest, and to the starting-point. This anchors the bandage. A second turn is carried directly over the first one until the left side of the chest is reached. The bandage is then carried obliquely upward, slightly overlapping the lower margin of the left breast, over the right shoulder, across the back of the left shoulder, under the left arm, and to the starting-point. It is then carried horizontally to the right side, across the back over

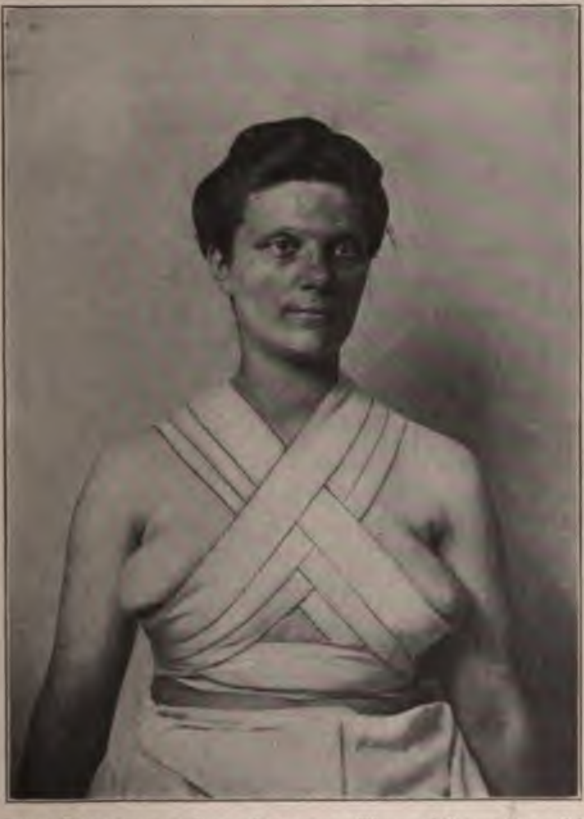

FIG. 350.—SPICA BANDAGE OF BOTH BREASTS. Three oblique turns of both breasts are completed. The second breast to be bandaged should be lifted each time the bandage comes down across it to prevent a downward drag.

the left shoulder, obliquely downward across the chest, slightly overlapping the lower margin of the right breast, which should be lifted as the bandage crosses it, so as to avoid a downward drag of the bandage.

The bandage is next carried across the right side, across the back, across the left side, one inch above the previous turns, obliquely upward across the left breast, over the left shoulder, across the left side, and horizontally around the chest one inch above the previous horizontal turn. When the bandage reaches the back, it is carried obliquely upward over the left shoulder, and obliquely downward over the right breast. These turns are continued until the bandage has passed three times over each shoulder (Fig. 350).

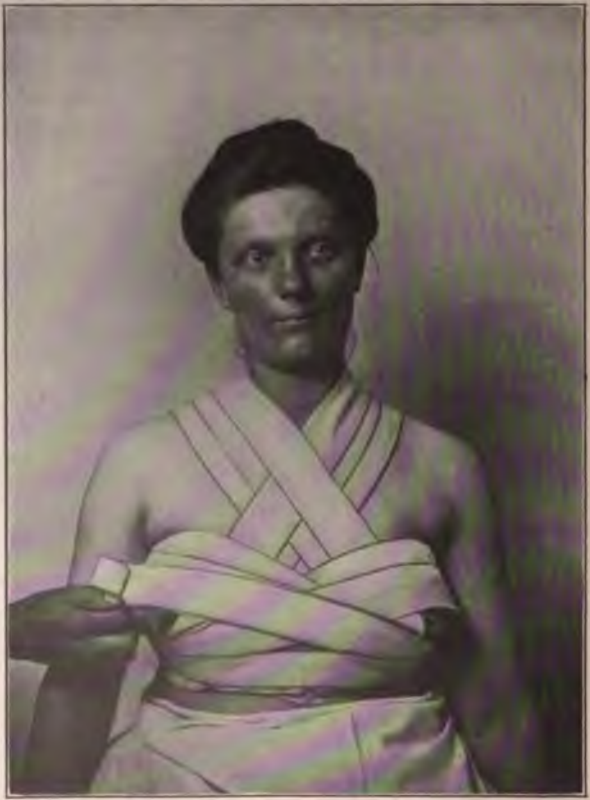

FIG. 351.—SPICA BANDAGE OF BOTH BREASTS. The oblique turns have been completed, and the serpentine turns for compression are nearing completion.

The overlapping on the shoulder should not exceed half an inch, as the space there is limited. When the bandage has reached this stage, both breasts will have been supported and compressed from below. The bandage should not be completed by four serpentine turns around the chest, the first one of which passes beneath the left breast and above the right breast; the second one above the left breast and beneath the right breast. The third follows the course of the first, but is placed nearer to the nipple of each breast, and the fourth follows the course of the second, but is placed nearer the nipple of each breast (Fig. 351).

No. 30. Velpeau; a Figure of Eight of the Chest and Shoulder; a Two and One-Half Inch Bandage.—The area covered by this bandage is the whole chest below the arms, one shoulder, and the whole of the corresponding arm, except the hand. It is of use to fix the arm firmly to the chest after

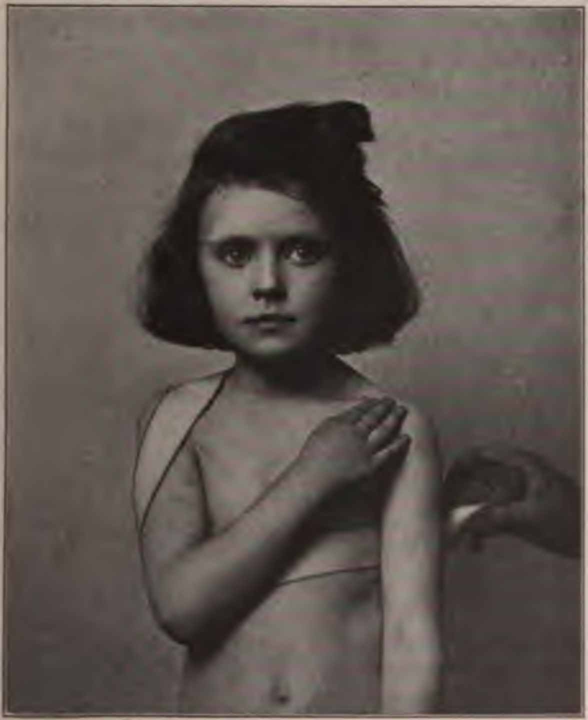

FIG. 352.—VELPEAU'S BANDAGE. The first turn is nearly completed. Note that the bandage has been turned over in order to avoid twisting it under the arm.

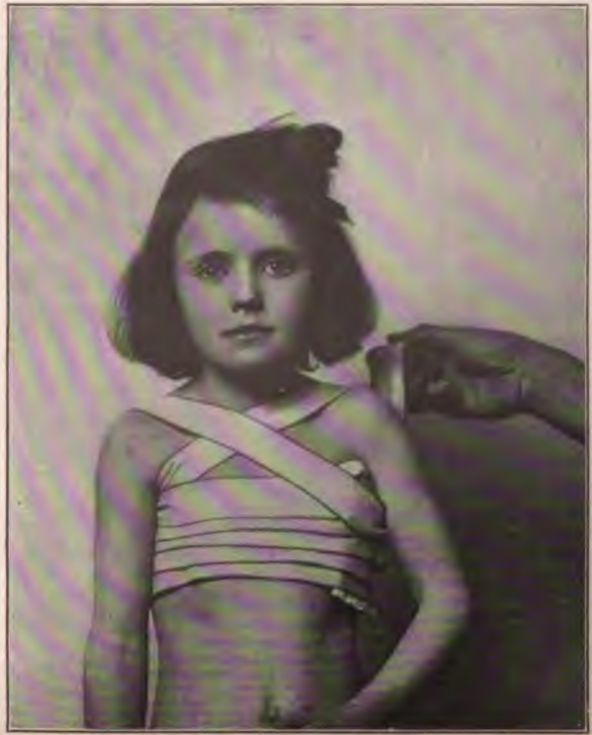

Fig. 355.—Desault's Bandage of the Chest and Arm, Showing Fixation of the Axillary Pad, and the Spiral of the Chest.

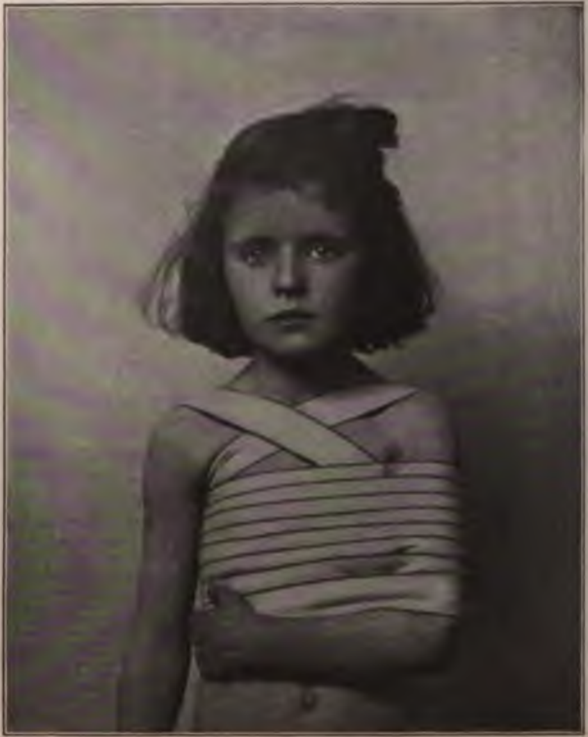

Fig. 356.—Desault's Bandage of the Chest and Arm. The second roller is used to fix the arm to the chest, thereby prying the shoulder outward.

Before the bandage is started, a wedge shaped pad or compress, with its base at least an inch in thickness, is placed base upward in the affected axilla; say the left one. The bandage is started in the center of the axillary pad, and is carried across the front of the chest, over the right shoulder, under the right arm, over the right shoulder, and across the back of the chest to the starting-point. This anchors the bandage, and prevents the pad from slipping down. A descending spiral of the chest is then applied until the lower limit of the pad is reached. The bandage is then carried spirally upward until the whole pad is covered in. The figure of eight turn across the right shoulder and under the right axilla with which the bandage was started should now be repeated to give it greater firmness (Fig. 355). The affected left arm is

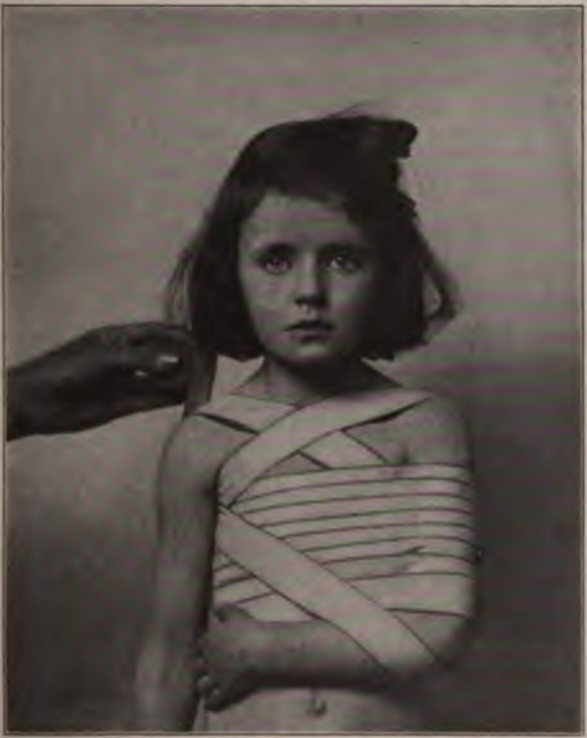

FIG. 357.—DESAULT'S BANDAGE OF THE CHEST AND ARM. This shows the completion of the first loop of the third roller. It is a triangle of which the oblique sides are in front of the chest, and the vertical side behind. The second loop, yet to be applied, is also a triangle, the oblique sides of which are at the back of the chest, and the vertical side in front.

then brought closely to the side, and the forearm is flexed to a horizontal level.

The second roller bandage is started over the sternum as high as the unaffected arm will permit, and is carried spirally downward around the chest until the elbow is reached (Fig. 356). The lower turns of this roller should be applied more firmly than the upper ones, as they are intended to press inward the elbow, and so to pry the shoulder outward upon the pad, which acts as a fulcrum.

The third roller is started in the right axilla, carried across the point of the chest, over the left shoulder, down the back of the left arm, under the left elbow and obliquely upward across the front of the chest to the starting-point (Fig. 357). This anchors the bandage, which is now directed backward instead of forward. It is then carried across the back of the chest, over the left shoul-

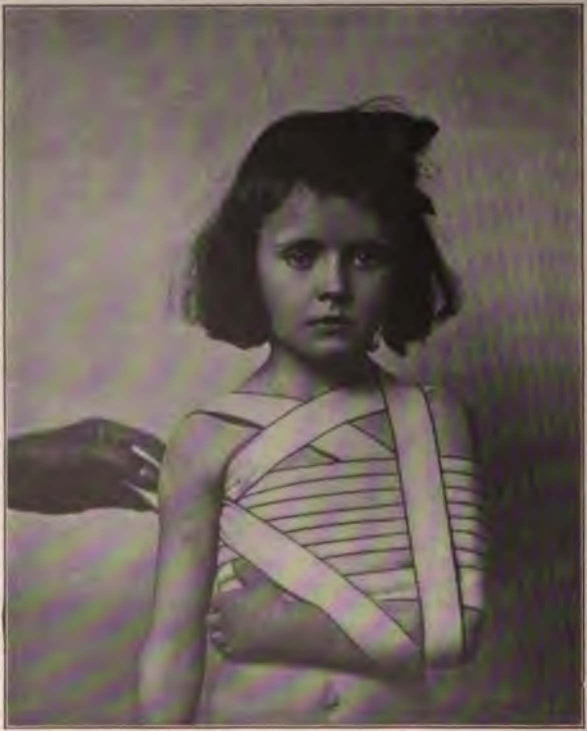

FIG. 358.—DESAULT'S BANDAGE OF THE CHEST AND ARM. The third roller is used to elevate the arm by means of two loops passed under the elbow. This figure shows the completion of the second loop.

der, down the front of the left arm, under the left elbow, and obliquely across the back to the starting-point in the right axilla (Fig. 358). These two loops around the affected arm and shoulder are repeated three times for greater security.

The addition of a sling completes the bandage.

No. 32. Descending Spiral of Abdomen; a Three Inch Bandage.—The area covered by this bandage is the abdomen and back. It is of use to keep a dressing in place and to prevent strain on a suture of the abdominal wall and also to prevent the escape of abdominal organs into the sac of an umbilical or a ventral hernia. This bandage may be a continuation of the descending spiral of the chest.

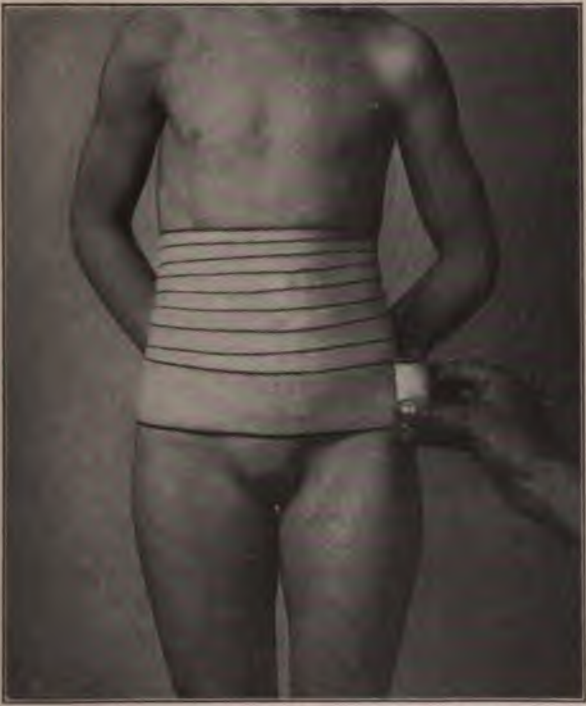

FIG. 359.—DESCENDING SPIRAL BANDAGE OF ABDOMEN, SHOWING ITS COMPLETION BELOW THE ILIAC CRESTS.

The bandage is started at the epigastrium, and is carried horizontally twice around the trunk. This anchors the bandage. The third and succeeding turns are made to overlap one another downward, each for a distance of one inch. The bandage is completed at the lower portion of the abdomen by a circular turn (Fig. 359). This bandage should extend below the iliac crests, as otherwise it has a tendency to slip upward. The individual turns should be held together by three vertical rows of stitches or narrow strips of adhesive. The bandage is more satisfactory when used upon men and stout women than it is upon women whose waists are very much smaller than their hips.

Ascending Spiral of Abdomen.—An ascending spiral bandage of the abdomen is similar to this descending spiral. It is started below the iliac crests, anchored by two circular turns, and carried spirally upward.

No. 33. Many Tailed Bandage of Abdomen; a Bandage Made of Six or Eight Two Inch or Wider Strips, Each About One Yard Long.—The area covered by this bandage is the back and abdomen. Its use is to keep a dressing upon

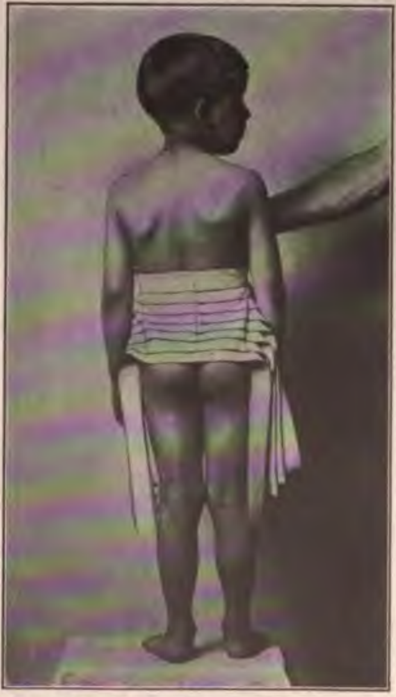

FIG. 360.—MANY TAILED BANDAGE BEFORE ITS APPLICATION, SHOWING ITS CONSTRUCTION. The lateral rows of stitching should not be placed farther forward than the posterior iliac spines.

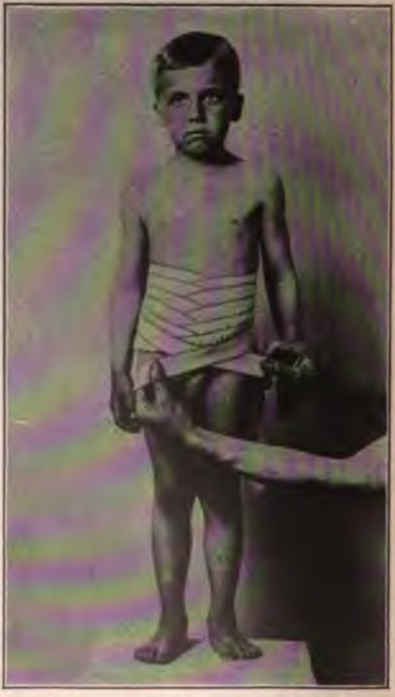

FIG. 361.—MANY TAILED BANDAGE OF THE ABDOMEN. The tails are brought forward alternately, and each one holds the one before.

an abdominal wound or to prevent strain of a sutured wound. If properly made, it is applicable to any abdomen, no matter how large or contracted. The bandage is made of strips of muslin or canton flannel, the width of which should vary from two to three inches, according to the size of the patient. Their length should be equal to one and one-third times the circumference of the body at the iliac crests. The strips are laid parallel on a table, each strip overlapping the adjacent one by two-thirds of its width, like clapboards on the side of a house. The strips are fixed in this relation by three rows of stitches; one across the center of the strips, and the other two from four to six inches to the right and left (Fig. 360). A sufficient number of strips should be used to give a bandage which will extend from the symphysis to the ensiform cartilage. Six are usually sufficient.

This bandage is applied by placing its center directly over the spine. It makes no difference whether the strips overlap upward or downward. The two tails of the strip nearest the body are crossed over the abdomen and drawn taut. The second tail holds the first. They should be directed slightly toward the opposite edge of the bandage (Fig. 361). The third tail is drawn across the second, and so on until all the tails are in place. The last one must be pinned.

BANDAGES OF THE UPPER EXTREMITY

No. 34. Ascending Spica of Shoulder; a Two Inch Bandage.—The area covered by this bandage is the upper portion of the arm, the sides and outer portion of the shoulder, and the circle of the neck. It is of use to keep a dressing in place and also to make a shoulder-cap out of a plaster of Paris bandage.

The bandage is started in the middle of the affected arm, and is carried around the arm in a circle. This anchors the bandage, which is then carried spirally upward until the axillary folds are encountered. The bandage is then carried over the outer portion of the shoulder, around the chest, under the opposite arm, and back again to the shoulder, the descending portion of the bandage crossing the ascending exactly midway between the front and back of the affected shoulder. Another circular turn of the arm is made, and a second turn around the chest.

This should be a half inch higher upon the shoulder than the preceding figure of eight turn, but on the opposite side of the chest it may exactly overlie the preceding one. Three or four additional figure of eight turns are made, without an intervening circular turn around the arm (Fig. 362). This completes the bandage.

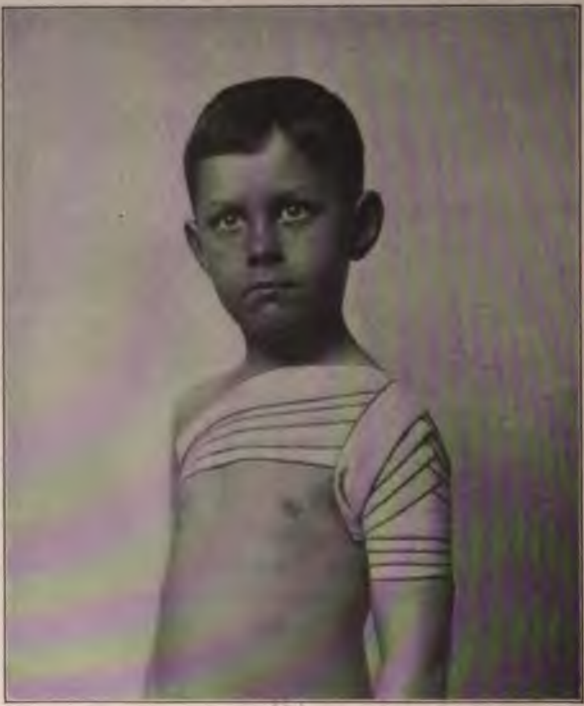

FIG. 362.—ASCENDING SPICA BANDAGE OF SHOULDER COMPLETE.

No. 35. Descending Spica of Shoulder; a Two Inch Bandage.—The area covered by this bandage and its uses are the same as those of the preceding bandage.

The spica bandage can be made to descend instead of ascend. After the arm is bandaged, the first figure of eight turn over the shoulder and around the chest is made at the extreme upper point of the area to be bandaged (Fig. 363). Each successive figure of eight turn is made a little lower on the affected shoulder.

No. 36. Spiral of Arm; a Two Inch Bandage.—The area covered by this bandage is the upper arm from above the elbow to the shoulder.

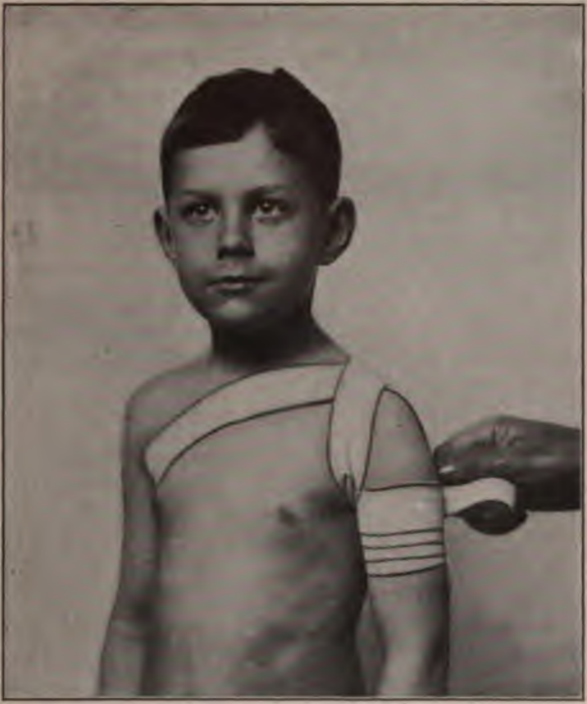

FIG. 363.—DESCENDING SPICA BANDAGE OF THE SHOULDER, SHOWING THE FIRST FIGURE OF EIGHT TURN.

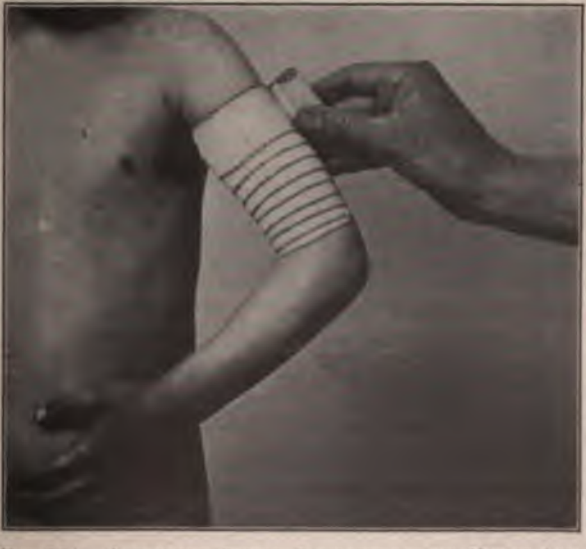

FIG. 364.—ASCENDING SPIRAL BANDAGE OF THE UPPER ARM.

This bandage is used to keep a dressing in place on the upper arm, for instance after vaccination; and also to retain coaptation splints after fracture of the shaft of the humerus.

It is anchored by a circular turn above the elbow and wound spirally upward (Fig. 364).

No. 37. Concentric Figure of Eight of Elbow, or Testudo Inversa; a Two Inch Bandage.—The area covered by this bandage is the region of the elbow-joint. It may be applied when the joint is partially or fully flexed. It is used to keep a dressing in place or to make pressure upon the joint.

The bandage is fixed by two circular turns around the upper part of the forearm, and is then carried obliquely across the anterior surface of the joint and around the upper arm, making there a complete circular turn (Fig. 365). It is then brought down over the anterior surface of the joint, and carried around the forearm a little higher up than before. These figure of eight turns are repeated until the elbow is covered, each one being nearer to the point of the olecranon.

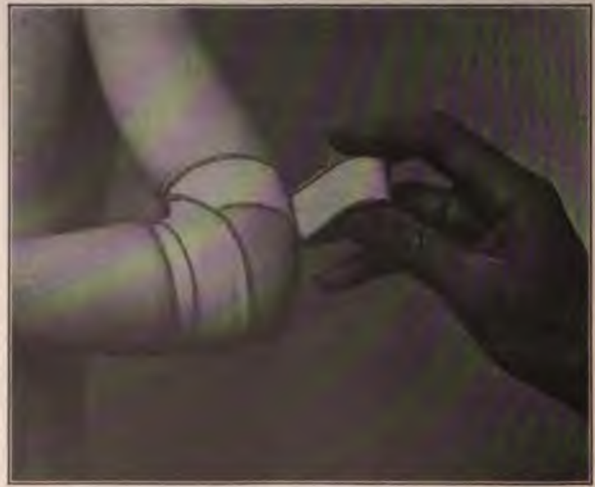

FIG. 365.—THE CONCENTRIC FIGURE OF EIGHT BANDAGE OF THE ELBOW, SHOWING THE COMPLETION OF THE FIRST FIGURE OF EIGHT TURN.

No. 38. Eccentric Figure of Eight of the Elbow, or Testudo Reversa; a Two Inch Bandage.—The area covered by this bandage is the region of the elbow-joint. It is applied when the joint is partially or fully flexed. This bandage is used to keep a dressing in place or to limit the motion of the joint.

The bandage is fixed by two circular turns directly around the elbow-joint, and passing over the tip of the olecranon. As the third turn reaches the olecranon, it is carried slightly below the second turn, but exactly overlies it again at the front of the elbow.

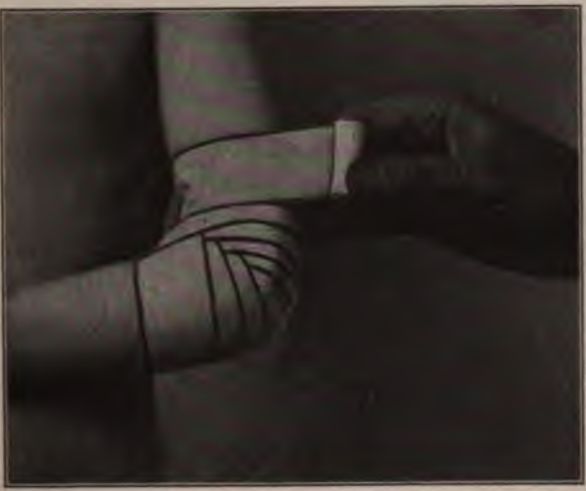

FIG. 366.—THE ECCENTRIC FIGURE OF EIGHT BANDAGE OF THE ELBOW, SHOWING THE COMPLETION OF THE BANDAGE.

The fourth turn is carried slightly above the second at the olecranon, but exactly overlies it at the front of the elbow. This process is repeated, each turn being farther and farther from the olecranon posteriorly until the elbow is covered (Fig. 366).

If this bandage is applied to retain the arm in a flexed position, the outermost figure of eight turns should alternate with circular turns around the forearm and upper arm. In this manner a web is formed which will prevent the extension of the joint. This rigidity is much greater if a starch bandage is used.

No. 39. Spiral Reverse of Forearm; a Two Inch Bandage.—The area covered by this bandage is the forearm from the wrist to the elbow. It is used to keep a dressing in place or to affix splints.

The bandage is fixed by a circular turn at the wrist, and is carried spirally upward. After two or three turns, depending on the shape of the arm, a fulness of the lower edge of the bandage is noticeable. The bandage should then be reversed (Fig. 367) each time that it is brought to the front of the arm. The upper part of the forearm is often of uniform size, so that the upper portion of the bandage may be a simple spiral. The reverses should all be made in the same line, either posteriorly or anteriorly.

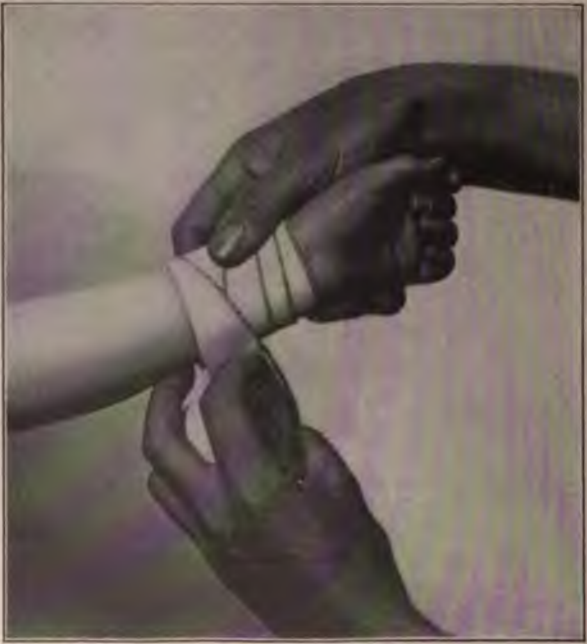

FIG. 367.—SPIRAL REVERSE BANDAGE OF FOREARM, SHOWING THE FIRST REVERSE.

No. 40. Figure of Eight of Forearm; a Two Inch Bandage.—The area covered by this bandage is the forearm from the wrist to the elbow.

The bandage is fixed by a circular turn at the wrist, and is carried spirally upward. After two or three turns, depending on the shape of the arm, the lower edge of the bandage is looser than the upper. The spiral is then changed to a figure of eight. The bandage is carried upward to the elbow, and circularly around the forearm, just below this joint. It is then brought down to the point where the spiral was discontinued (Fig. 368). A circular turn is then made, and following this, another figure of eight turn is made to overlap the preceding by one-half the width of the bandage. A number of such figure of eight turns are made, and

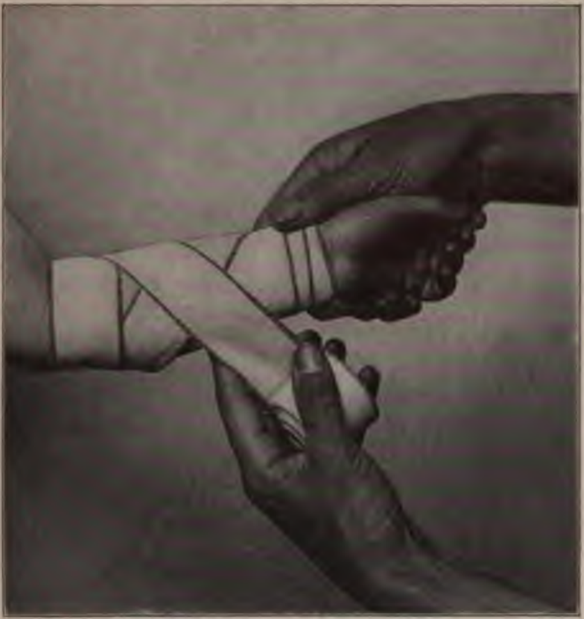

Fig. 368.—Figure of Eight Bandage of Forearm, Showing the Completion of the First Figure of Eight Turn.

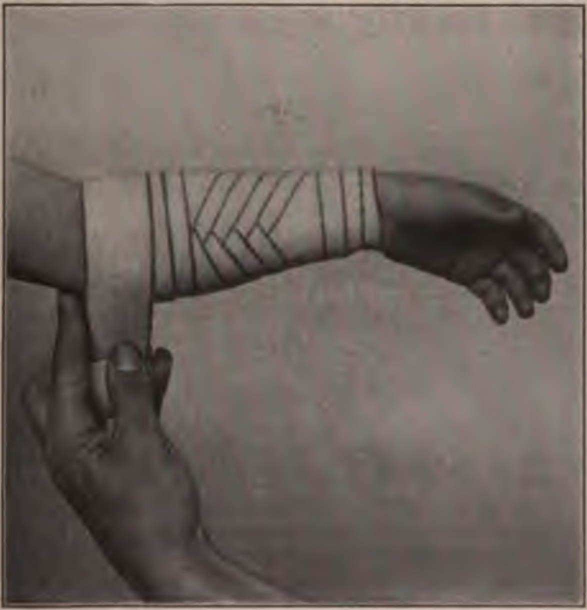

Fig. 369.—Figure of Eight Bandage of Forearm Completed. The pattern made by a spiral reverse bandage, when completed, is the same as this.

the covering of the forearm is completed by two or three circular turns (Fig. 369). The crossings of the figure of eight turns may be either upon the anterior or posterior surface of the forearm.

No. 41. Figure of Eight of the Hand; a One and One-Half Inch Bandage.—The area covered by this bandage is the wrist, the back of the hand, and the palm of the hand with the exception of a small portion at the base of the thumb. It is used to keep a dressing in place or to affix an anterior or posterior splint.

The bandage is fixed by a circular turn at the wrist, and is carried across the back of the hand to the center of the first phalanx, or, if necessary, clear to the tips of the fingers. It is then carried circularly around the four fingers, and then spirally upward. As the hand is reached, the bandage is carried obliquely upward across the back of the hand to the wrist, around which a circular turn is made (Fig. 370). The bandage is then carried obliquely downward across the back of the hand, and a circular turn is made around the hand to cover the triangular gap which

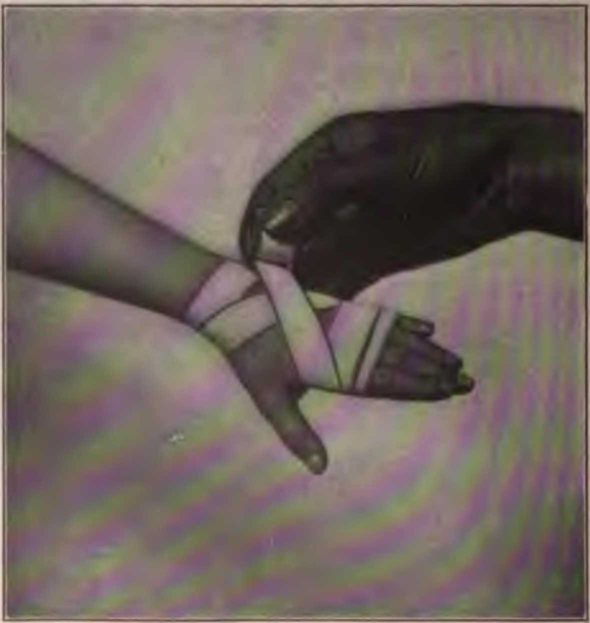

Fig. 370.—Figure of Eight Bandage of the Hand, Showing the Completion of the First Figure of Eight Turn.

would otherwise be left bare. Additional figure of eight turns are then applied, each overlapping its predecessor upward by one-half the width of the bandage. The thumb should not be included in the bandage of the hand; if it is desired to cover it, separate turns for the purpose should be made.

No. 42. Spiral Reverse of Hand; a One and One-Half Inch Bandage.—The area covered by this bandage is the wrist, the back of the hand, and the palm of the hand with the exception of a small portion at the base of the thumb. It is used to keep a dressing in place or to affix a long posterior or anterior splint.

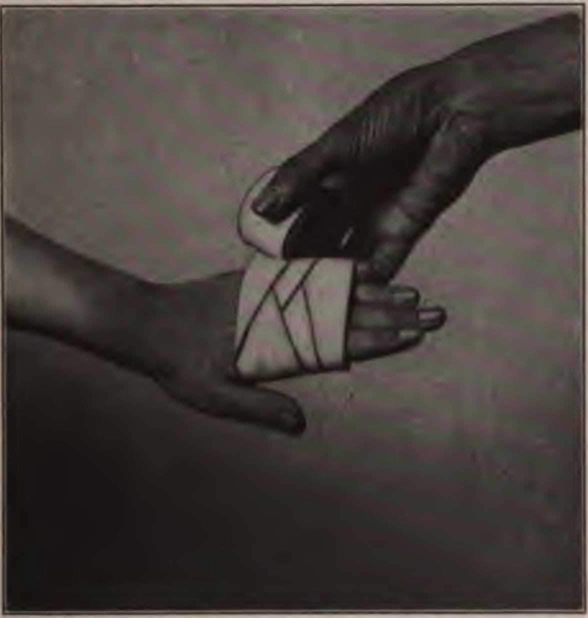

FIG. 371.—SPIRAL REVERSE BANDAGE OF THE HAND SHOWING TWO REVERSES.

The bandage is fixed by a circular turn at the wrist, and is carried across the back of the hand to the center of the first phalanx, or, if necessary, clear to the tips of the fingers. It is then carried circularly around the four fingers and then spirally upward. As the hand is reached the bandage is reversed, in order to make it fit properly (Fig. 371). The thumb should not usually be included in the bandage. If it is desired to cover it, separate turns should be made for the purpose.

No. 43. Spica of the Thumb; a One Inch Ba
—The area covered by this bandage is the thumb, includi dorsal and palmar surfaces of its base, and the circle of the It is useful to keep a dressing in place, or to prevent mo the joints of the thumb.

The bandage is fixed by a circular turn at the wrist, a ried obliquely over the back of the thumb to the distal p The thumb is then covered by an ascending spiral bandag just before the web of the thumb is reached this is change figure of eight bandage around the thumb and wrist (Fig. The first figure of eight turn around the wrist should be fo by a circular turn for greater security, and the first figure o turn around the thumb should be followed by a circular t cover the triangular gap which would otherwise be left bare. additional figure of eight turns complete the bandage. The

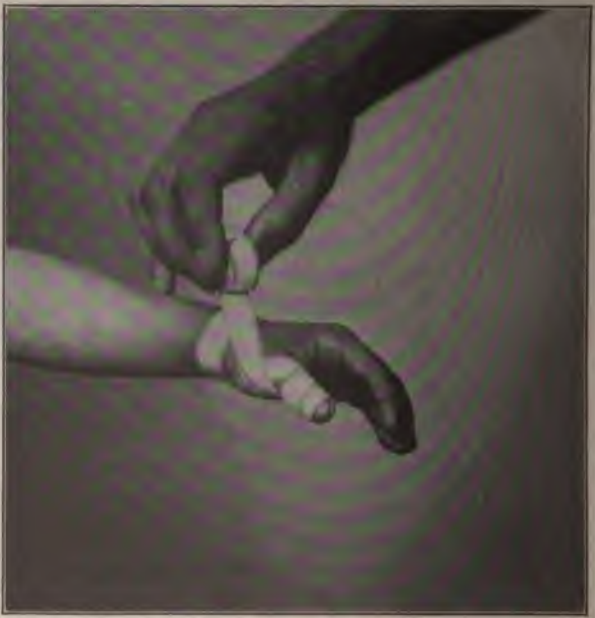

FIG. 372.—SPICA BANDAGE OF THE THUMB, SHOWING COMPLETION OF THE FIGURE OF EIGHT TURN.

ings of the figure of eight turns may be placed more poster or anteriorly, according to the portion of the thumb which desired to cover. If the bandage is used to fix the joint the thumb, it is well to keep these crossings on the posterior surface.

No. 44. Spiral Reverse of Finger; a One Inch Bandage.—The area covered by this bandage is the finger. If it is desired to cover the end of the finger, this bandage should be combined with the recurrent bandage (No. 47). The bandage is useful to keep a dressing in place, or to prevent motion in the joints of the finger. The finger can be bandaged by a simple spiral, but in most cases a better fitting bandage is obtained by using the spiral reverse, or figure of eight.

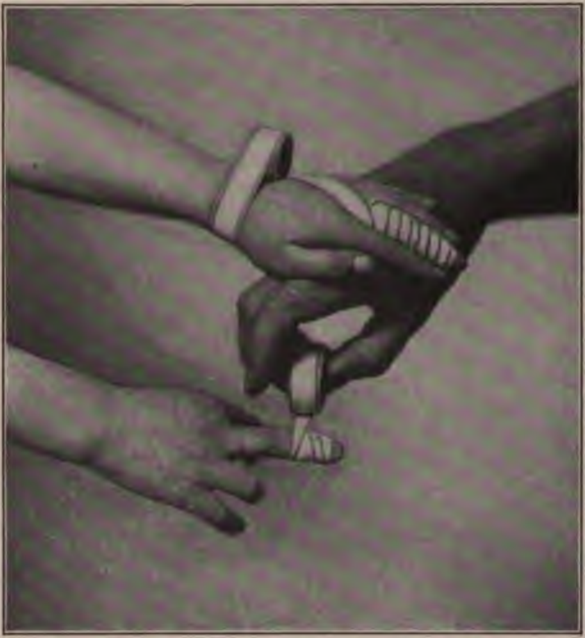

FIG. 373.—SPIRAL REVERSE BANDAGE OF THE FINGER, SHOWING THE SECOND REVERSE. The middle finger of the other hand has been completely bandaged by the same method.

The bandage is anchored by a circular turn around the terminal phalanx of the finger, and an ascending spiral started. Each time, as the bandage is carried upward over the back of the finger, it should be reversed (Fig. 373). When the base of the finger is reached the bandage may be fastened, or it may be carried over the back of the hand and around the wrist in two figure of eight turns.

No. 43. Spica of the Thumb; a One Inch Bandage.—The area covered by this bandage is the thumb, including the dorsal and palmar surfaces of its base, and the circle of the wrist. It is useful to keep a dressing in place, or to prevent motion in the joints of the thumb.

The bandage is fixed by a circular turn at the wrist, and carried obliquely over the back of the thumb to the distal phalanx. The thumb is then covered by an ascending spiral bandage, and just before the web of the thumb is reached this is changed to a figure of eight bandage around the thumb and wrist (Fig. 372). The first figure of eight turn around the wrist should be followed by a circular turn for greater security, and the first figure of eight turn around the thumb should be followed by a circular turn to cover the triangular gap which would otherwise be left bare. Two additional figure of eight turns complete the bandage. The crossings of the figure of eight turns may be placed more posteriorly or anteriorly, according to the portion of the thumb which it is desired to cover. If the bandage is used to fix the joints of

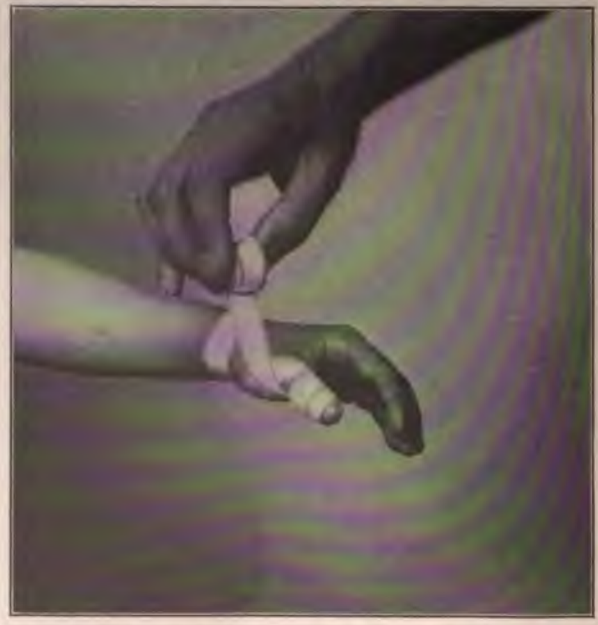

FIG. 372.—SPICA BANDAGE OF THE THUMB, SHOWING COMPLETION OF THE FIRST FIGURE OF EIGHT TURN.

the thumb, it is well to keep these crossings on the posterior surface.

No. 44. Spiral Reverse of Finger; a One Inch Bandage.—The area covered by this bandage is the finger. If it is desired to cover the end of the finger, this bandage should be combined with the recurrent bandage (No. 47). The bandage is useful to keep a dressing in place, or to prevent motion in the joints of the finger. The finger can be bandaged by a simple spiral, but in most cases a better fitting bandage is obtained by using the spiral reverse, or figure of eight.

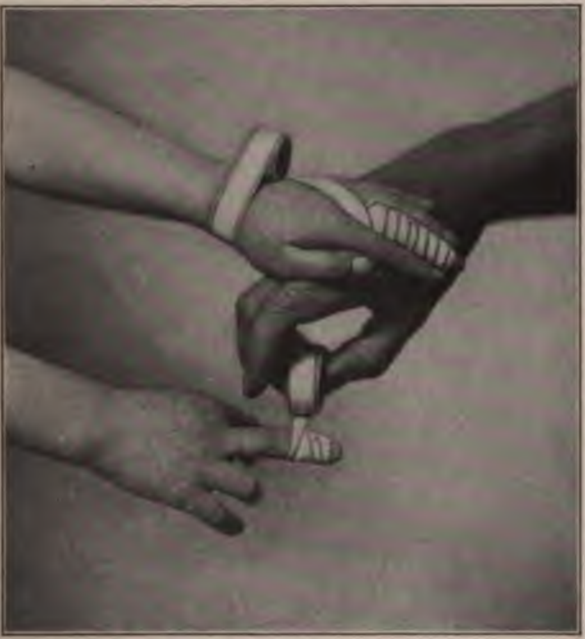

Fig. 373.—Spiral Reverse Bandage of the Finger, Showing the Second Reverse. The middle finger of the other hand has been completely bandaged by the same method.

The bandage is anchored by a circular turn around the terminal phalanx of the finger, and an ascending spiral started. Each time, as the bandage is carried upward over the back of the finger, it should be reversed (Fig. 373). When the base of the finger is reached the bandage may be fastened, or it may be carried over the back of the hand and around the wrist in two figure of eight turns.

bandaged, while the palm is left free; hence the name "gauntlet" has been applied to the bandage.

No. 47. The Recurrent of the Finger; a One and One-Half Inch Bandage.—The area covered by this bandage is the finger, including its tip, a part of the back of the hand, and a circle of the wrist. This bandage is used to keep a dressing in place over the finger. Frequently two or more fingers are bandaged together.

The bandage is started on the dorsum of the finger near its base, and is carried directly over the end of the finger, and nearly to its base on the palmar surface. It is then carried over the end of the finger back to the starting-point, overlapping the previous turn by about a third of its width. It is again carried over the end of the finger to the palmar surface, overlapping the previous turn, in the opposite direction, by two-thirds of its width. Usually these three recurrent turns are sufficient to leave a lateral excess of bandage at the tip of the finger. This excess is smoothly band-

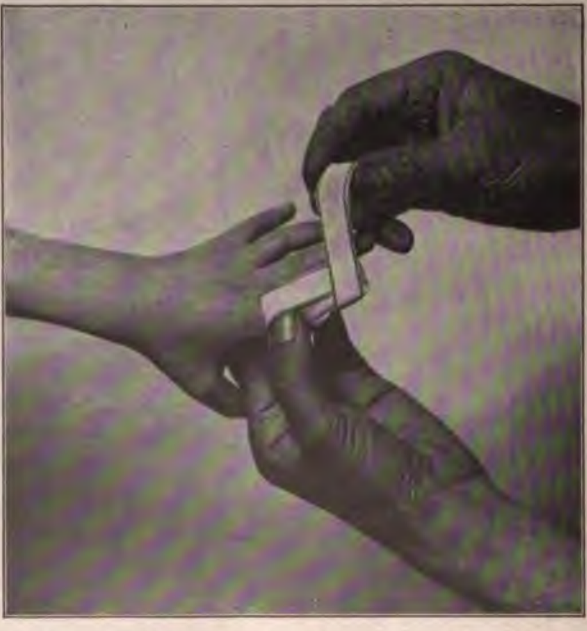

FIG. 376.—RECURRENT BANDAGE OF THE FINGER, SHOWING ITS APPLICATION TO THE FOREFINGER. One half of the lateral excess of the bandage at the tip of the finger has been caught by the first figure of eight turn.

aged in with figure of eight or spiral reverse turns (Figs. 376 and 377), according to the directions given for bandages Nos. 44 and 45. When the base of the finger is reached, two figure of eight turns are carried across the back of the hand and around the wrist.

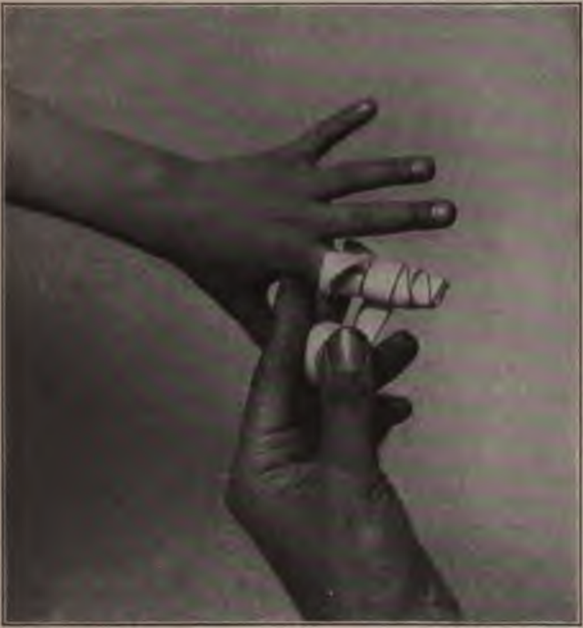

FIG. 377.—RECURRENT BANDAGE OF THE FINGER AT A LATER STAGE.

BANDAGES OF THE LOWER EXTREMITY

No. 48. Ascending Spica of One Groin; a Three Inch Bandage.—The area covered by this bandage is a circle of the trunk, the groin, the corresponding lower quadrant of the abdomen, and the upper portion of the thigh. This bandage is useful to keep a dressing in place or to make pressure in the groin.

The bandage is anchored by two circular turns around the upper part of the thigh, crossing the front of the thigh from within outward. It is then carried obliquely upward and outward to the crest of the ilium on the same side, once around the body, and across the back to the crest of the ilium on the opposite side. From there it is carried across the abdomen, as low down as the symphysis pubis, and back to the starting-point (Fig. 378). It is carried circularly around the thigh to cover the triangular gap which would otherwise be left bare. Additional figure of eight turns are then applied, each of which overlaps the previous figure of eight turn upward by one-third the width of the bandage. The line of intersection of these figure of eight turns should be a vertical one, and should cross the point where the greatest amount of pressure is needed. If the final descending turns of the figure of eight tend to slip downward, they should each be pinned where they cross the vertical line referred to (Fig. 379).

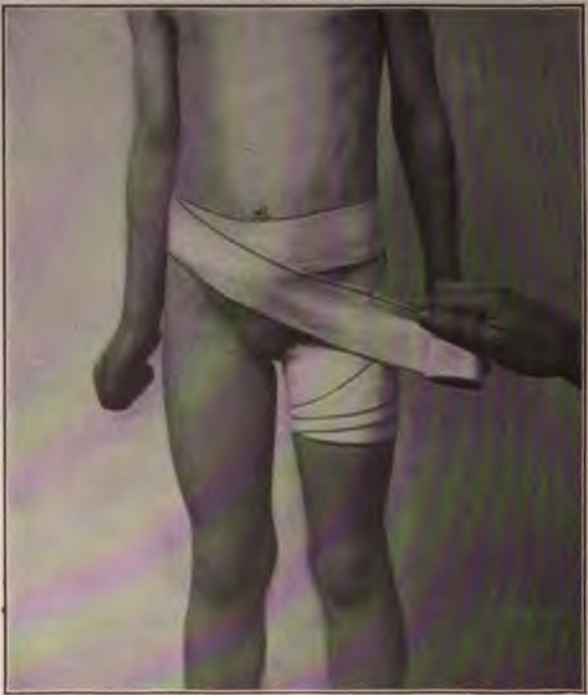

Fig. 378.—Ascending Spica Bandage of one Groin, Showing the Completion of the First Figure of Eight Turn. Note that both the ascending and descending portions of the figure of eight are low down. Subsequent turns will overlap this one upward.

No. 49. Descending Spica of One Groin; a Three Inch Bandage.—The area covered by this bandage and its uses are the same as those of the ascending spica of one groin (No. 48).

The bandage is anchored around the iliac crest, and carried obliquely downward across the upper part of the groin. It is then carried around the thigh and obliquely upward across the upper part of the groin, and once more around the body. Succeeding figure of eight turns are made to cross the groin, each a little lower down than the preceding one. In other words, the application of this bandage is the reverse of the application of the ascending spica of the groin described above.

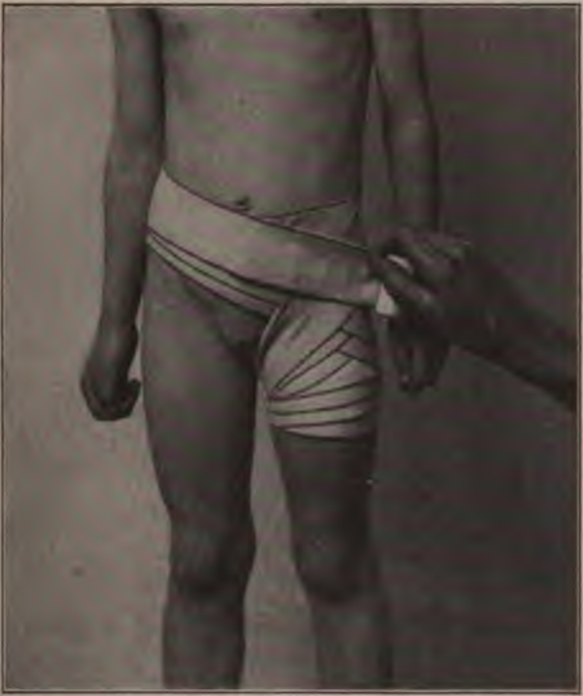

FIG. 379.—ASCENDING SPICA BANDAGE OF ONE GROIN, READY FOR FASTENING.

No. 50. Ascending Spica of Both Groins; a Three Inch Bandage.—The area covered by this bandage is a circle around the pelvis, the lower portion of the abdomen, both groins, and the upper portion of both thighs. This bandage is useful to keep dressings in place, or to make pressure in both groins.

The bandage is anchored by two circular turns around the upper part of the left thigh, crossing the front of the thigh from within outward. It is then carried obliquely upward and outward to the crest of the ilium on the same side, once around the body, and across the back to the crest of the right ilium. From there it is carried across the right groin, one and one-half times around the right thigh, and upward just above the symphysis pubis to the crest of the left ilium. It is next carried across the back, and above the crest of the right ilium, over the symphysis pubis, and downward across the left groin (Fig. 380). These various turns are repeated three or four times until the bandage is complete. Each figure of eight overlaps the previous one upward for a distance equal to one-third of the width of the bandage. It will be noted that the bandage is carried obliquely upward across one groin from within outward, and obliquely downward across the other groin, from without inward. It is necessary to carry the bandage once around the trunk between these two turns, as otherwise the bandage will slip down the back. When the bandage is carried upward across the groin from without inward, it makes almost a complete circle of the trunk before it is carried down-

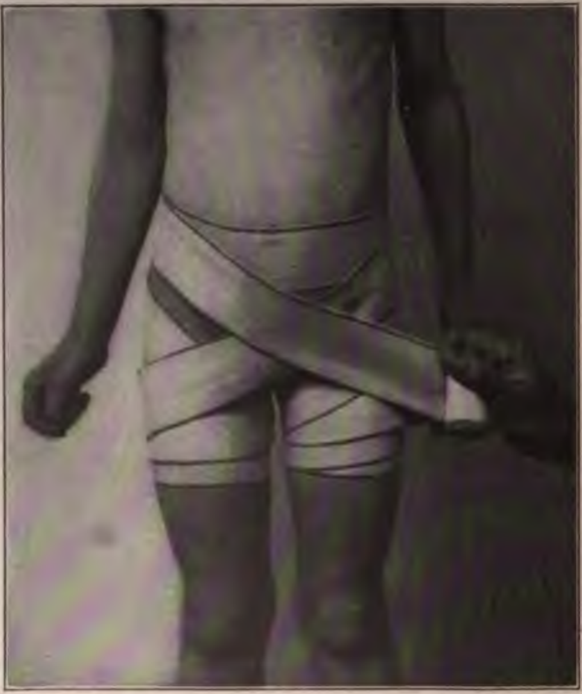

FIG. 380.—ASCENDING SPICA BANDAGE OF BOTH GROINS, SHOWING THE DOUBLE FIGURE OF EIGHT TURN ALMOST COMPLETED.

ward and outward across the other groin; hence, it is not necessary to carry the bandage once around the trunk between these two turns, as it shows no tendency to slip down.

No. 51. Descending Spica of Both Groins; a Three Inch Bandage.—The area covered by the descending spica of both groins and its uses are similar to those of the ascending spica of both groins (No. 50).

The bandage is anchored by a circular turn around the iliac crests and carried downward in figure of eight turns alternately over the right and left groins, the lower figure of eight turn being combined with circular turns around the thighs. (Compare No. 50.)

No. 52. Ascending Spica of the Buttock; a Three Inch Bandage.—The area covered by this bandage is the buttock, a circle around the trunk, and one around the thigh. It is useful to keep a dressing in place, or to make pressure upon the buttock.

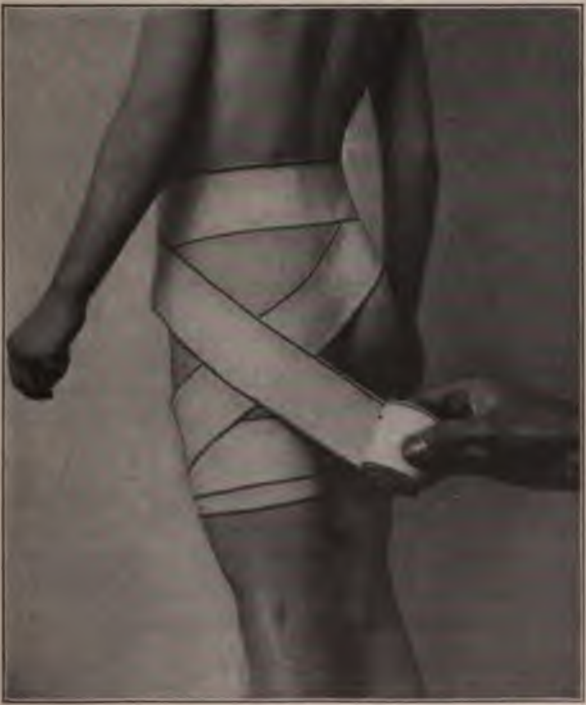

FIG. 381.—ASCENDING SPICA BANDAGE OF THE BUTTOCK, SHOWING THE COMPLETION OF THE FIRST FIGURE OF EIGHT TURN.

The bandage is anchored by two circular turns around the upper part of the thigh, crossing the back of the thigh from within outward. It is then carried obliquely across the buttock to the loin at the level of the crest of the ilium. It is then carried one and one-half times around the body, and obliquely downward across the buttock (Fig. 381). Next a circular turn is made around the thigh, slightly above the preceding one, and a figure of eight turn around the body overlapping the previous figure of eight turn upward by one-third the width of the bandage. This is repeated until the buttock has been covered in (Fig. 382). The points of intersection of these figure of eight turns should all fall in a vertical line, and that vertical line should be situated where the greatest amount of pressure is required. This may be as far forward as the great trochanter, or nearly back to the median line.

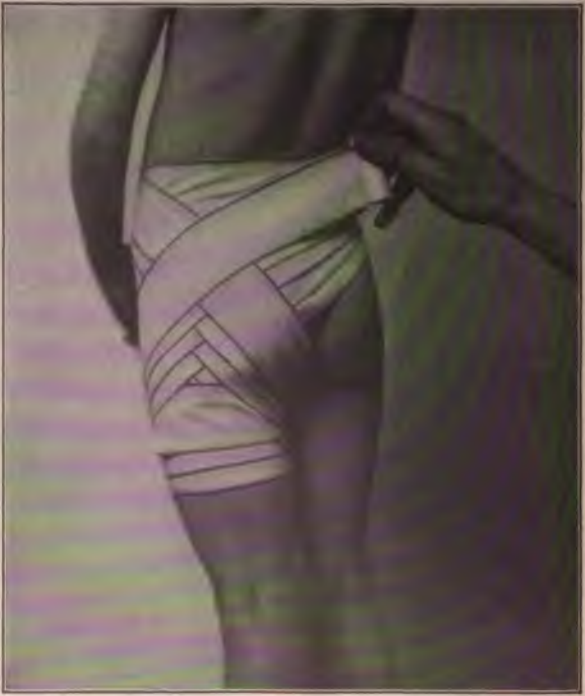

Fig. 382.—Ascending Spica Bandage of the Buttock Completed.

Descending Spica of the Buttock.—The descending spica of the buttock is similar to the above excepting that it is anchored around the waist and the figure of eight turns progress downward.

No. 53. Crossed Perineal; a Three Inch Bandage.—The area covered by this bandage is the perineum, the upper portion of both thighs, and the lower portion of the trunk. It is useful to make pressure upon the perineum, or to hold a dressing in place.

The bandage is anchored by a circular turn around the pelvis just beneath the crest of the ilia, crossing the back from the left side to the right. It is then carried across the right groin, diagonally backward across the perineum, across the back of the left thigh, and upward over the left trochanter, and across the abdomen from left to right (Fig. 383). It is then carried around the pelvis, crossing the back this time from right to left, and obliquely downward across the left groin, across the perineum, around the back of the right thigh and above the right trochanter, until the circle of the pelvis is again reached (Fig. 384). These turns may be repeated as many times as are necessary.

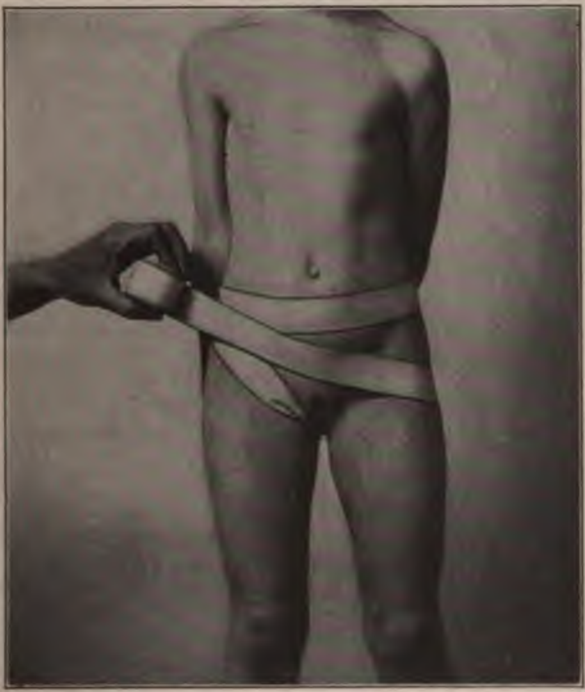

FIG. 383.—CROSSED BANDAGE OF PERINEUM; FIRST FIGURE OF EIGHT TURN IS AROUND THE LEFT THIGH.

It will be observed that this bandage is made up of a series of figures of eight around one thigh and the pelvis, alternating with figures of eight around the other thigh and pelvis; and that the direction in which the bandage is carried around the pelvis is changed each time the bandage goes around a thigh.

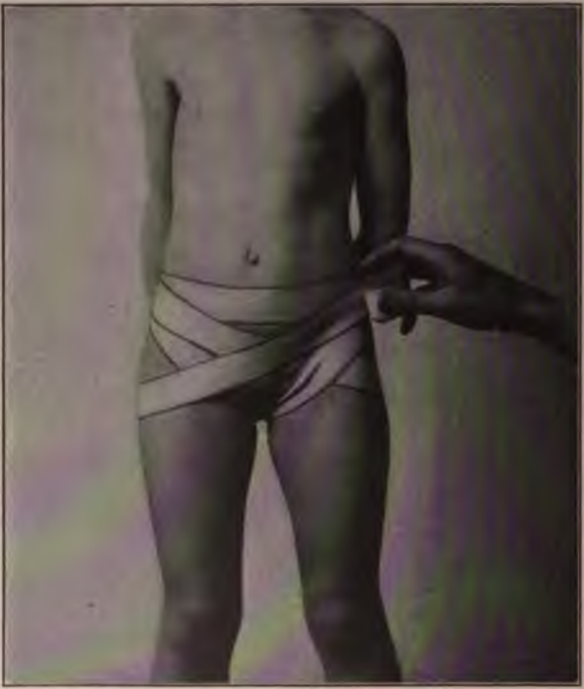

FIG. 384.—CROSSED BANDAGE OF PERINEUM; SECOND FIGURE OF EIGHT TURN IS AROUND THE RIGHT THIGH.

No. 54. Spiral Reverse of Thigh; a Three Inch Bandage.—The area covered by this bandage is the thigh. In most persons the circumference of the thigh increases upward, so that a simple spiral will not fit accurately, and even the spiral reverse, though accurately applied, will not long remain in position when the patient is walking about. For this reason it is better to combine this bandage in most ambulant cases with the ascending spica of the groin (No. 48). This bandage is used to make pressure upon the thigh, or to hold a dressing in place.

The bandage is anchored by a circular turn around the thigh just above the knee, and is carried spirally upward, each turn

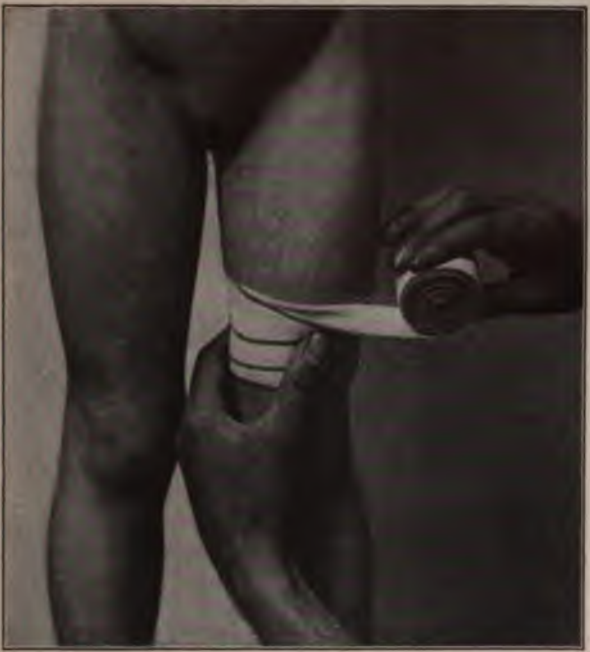

FIG. 385.—SPIRAL REVERSE BANDAGE OF THIGH, SHOWING THE INTRODUCTION OF THE FIRST REVERSE.

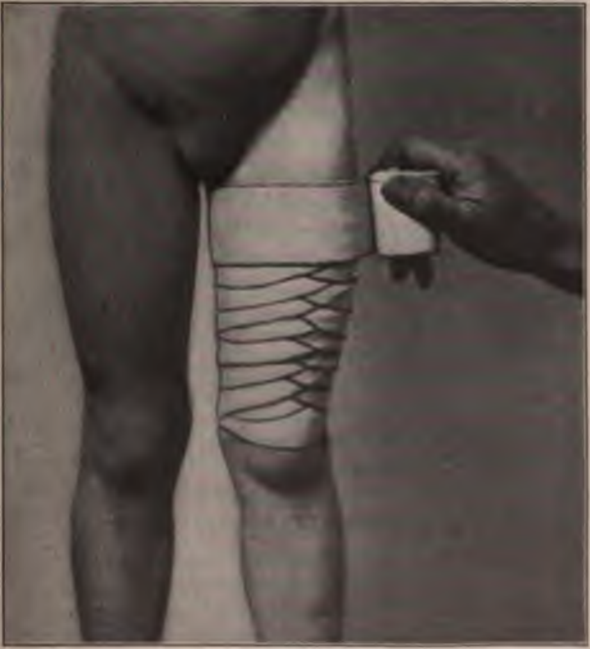

FIG. 386.—SPIRAL REVERSE BANDAGE OF THIGH COMPLETED.

overlapping the preceding one by one-third of its width. As soon as it becomes evident that the upper edge of the bandage is tighter than the lower, the bandage should be reversed every time it is brought to the front of the thigh (Fig. 385). The bandage may be completed by a circular turn just below the groin (Fig. 386), or it may be continued in the form of a spica. In either case, slipping of the individual turns of the bandage may be prevented by two or three vertical strips of adhesive plaster, or by two or three vertical rows of stitches. This precaution is recommended in the case of all stout persons who are walking about, as otherwise the physician is likely to be embarrassed by the information that the bandage slipped down to the shoe within half an hour.

No. 55. Concentric Figure of Eight of Knee, or Testudo Inversa; a Two and One-Half Inch Bandage.—The area covered by this bandage is the region of the knee-joint. It may be applied when the joint is extended or flexed. It is used to keep a dressing in place, or to make pressure upon the joint.

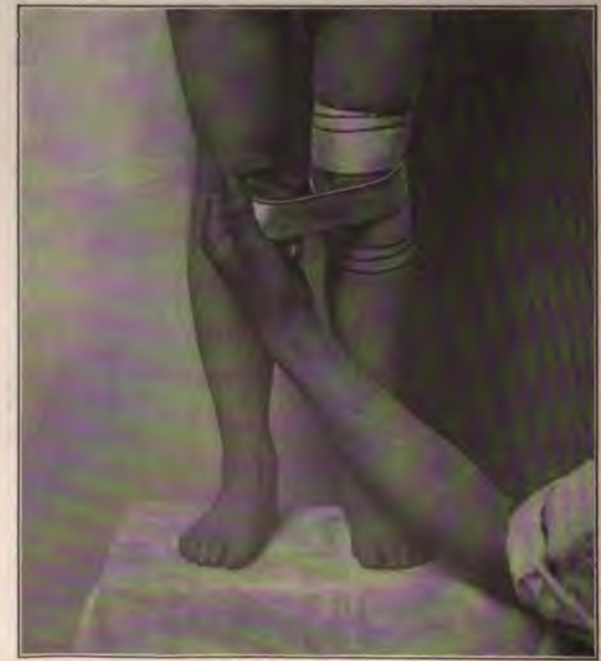

FIG. 387.—CONCENTRIC FIGURE OF EIGHT BANDAGE OF KNEE. All the spiral turns are in place, and the first figure of eight is about to be completed.

The bandage is fixed by a circular turn around the upper part of the leg, and is carried spirally upward until it almost reaches the patella. It is then carried obliquely across the posterior surface of the joint, and across the front of the thigh, high enough up to lie above the extreme upper limit of the synovial membrane of the joint. It is then carried around the thigh in one or more descending spiral turns, until it reaches nearly to the patella (Fig. 387). A series of figure of eight turns is next applied, each one nearer to the center of the patella, until the whole surface is covered. A circular turn over the patella completes the bandage. The crossings of these figure of eight turns are at the back of the leg, so that they do not show when the bandage is viewed from in front (Fig. 388).

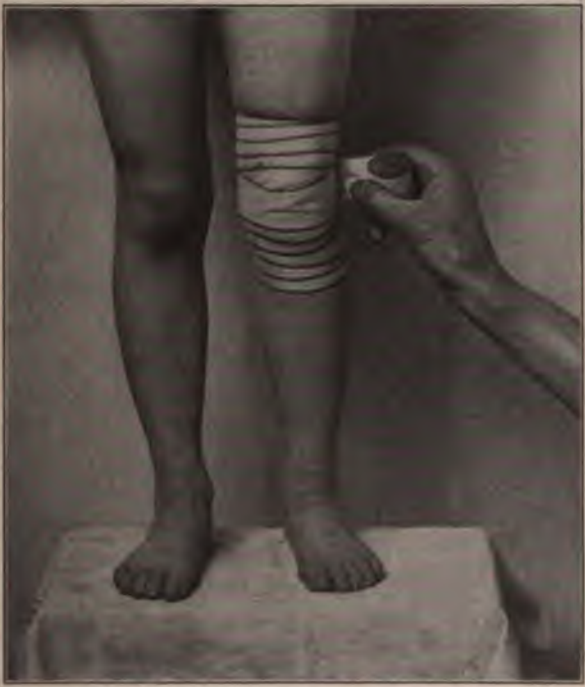

FIG. 388.—CONCENTRIC FIGURE OF EIGHT BANDAGE OF KNEE, COMPLETE.

No. 56. Eccentric Figure of Eight of Knee, or Testudo Reversa; a Two and One-Half Inch Bandage.—The area covered by this bandage is the region of the knee-joint. It is applied when the joint is either extended or flexed. It is used to keep a dressing in place, or to make pressure upon the joint, or to limit its motion.

The bandage is fixed by two circular turns directly around the knee-joint. As the third turn reaches the patella, it is carried slightly above the second turn, but exactly overlies it at the back of the knee. The fourth turn is carried slightly below the second at the patella, but crosses it at the median line behind. This process is repeated, each figure of eight turn being farther and farther from the patella, until the joint is covered (Fig. 389). It will be found of advantage to interpose a circular turn between each figure of eight turn, as the outer limit of the joint is approached, carrying these circular turns alternately around the leg and around the thigh.

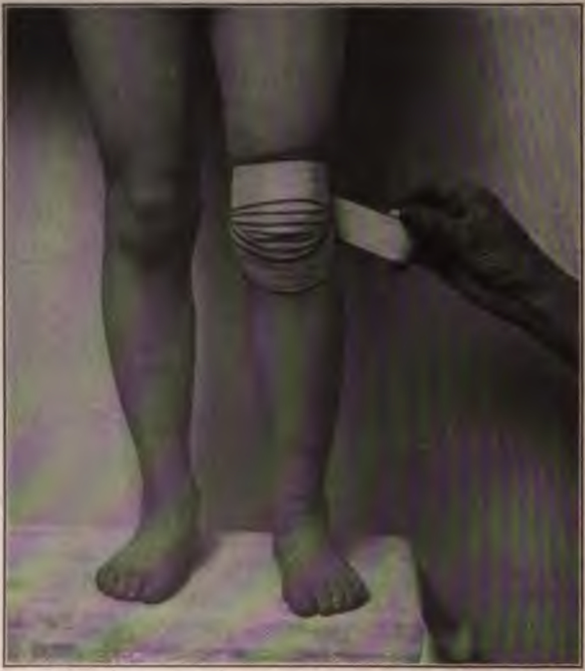

FIG. 389.—ECCENTRIC FIGURE OF EIGHT BANDAGE OF THE KNEE, COMPLETED.

No. 57. Figure of Eight of Both Knees; a Two and One-Half Inch Bandage.—The area covered by this bandage is that of both knees. It is applied when the joints are extended, and is used to prevent flexion of the knees and abduction of the thighs; for example, after perineorrhaphy.

A thick compress is laid between the knees, and bandaged to one of them by a few circular turns around the leg and thigh. This anchors the bandage. It is then carried across the front of both knees, and spirally upward around both thighs to a short distance above the knees, and downward across the front of the knees to the calves of the legs. From this lower limit the bandage is carried upward with spiral and figure of eight turns sufficient in number to entirely cover the knees (Fig. 390). Two vertical strips of adhesive plaster or two vertical rows of stitching will add to the stability of this bandage.

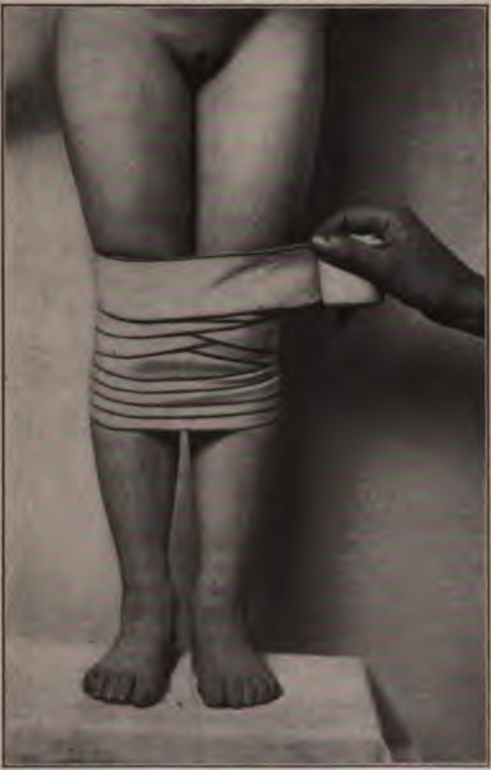

FIG. 390.—FIGURE OF EIGHT BANDAGE OF BOTH KNEES COMPLETED.

No. 58. Figure of Eight of Leg; a Two and One-Half Inch Bandage.—The area covered by this bandage is the leg

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from the ankle to the knee. It is used to hold a dressing in place. If there is a tendency for the leg to swell, this bandage should be combined with the figure of eight of the ankle (No. 60). This combination is the usual bandage for ulcer of the leg, and is described in detail as No. 61.

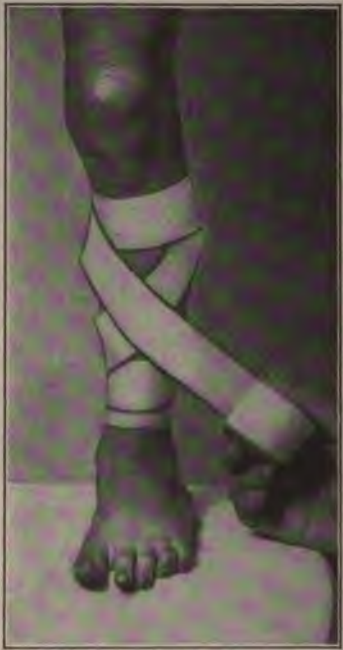

FIG. 391.—FIGURE OF EIGHT BANDAGE OF THE LEG, SHOWING THE FIRST FIGURE OF EIGHT TURN. Note that the bandage is carried one and one-half times around the leg above the calf.

The bandage is anchored by a circular turn above the ankle, and is carried spirally upward until the lower margin becomes full, as it usually does after three spiral turns. Figure of eight turns are then made, each one reaching above the calf, and each one a little higher on the leg than its predecessor. The first figure of eight turn should be carried one and one-half times around the calf before it is brought obliquely downward (Fig. 391). This will avoid any risk of its slipping. The intersections of the figure of eight turns should be properly placed in the median line. The bandage is completed by a circular turn around the calf. Its appearance is the same as that of No. 61, except that the ankle and foot are not covered (see Fig. 395).

No. 59. Spiral Reverse of Leg; a Two and One-Half Inch Bandage.—The area covered by this bandage is the leg from above the ankle to below the knee. It is used to hold a dressing in place and to reduce or prevent swelling of the leg. When used for the latter purpose, it should be combined with No. 60.

The bandage is anchored by a circular turn just above the malleoli, and is carried spirally upward, each turn overlapping the previous one by one-third of its width. Except in very thin persons, it is necessary to begin reverses almost immediately. These should be made in the median line of the leg anteriorly

(Fig. 392). Just before the maximum diameter of the calf is reached the reverses are discontinued, and the bandage is completed by a simple spiral. The bandage should not extend high enough to interfere with flexion at the knee-joint.

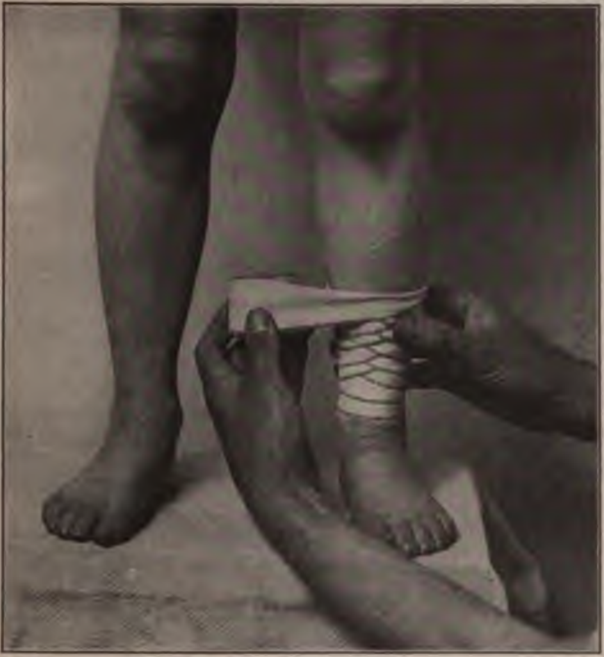

FIG. 392.—SPIRAL REVERSE BANDAGE OF THE LEG, SHOWING INTRODUCTION OF REVERSES PLACED EXACTLY IN THE MEDIAN LINE OF THE LEG.

No. 60. Figure of Eight of Ankle; a Two Inch Bandage.—The area covered by this bandage is a circle around the foot, the anterior portion of the ankle, and a circle of the leg immediately above it. It is used to keep a dressing in place, or to make pressure upon the ankle-joint, or to limit its motion. It is often combined with the spiral reverse of the leg (No. 59), and forms a part of the figure of eight of the foot and leg (No. 61).

The bandage is fixed by a circular turn around the leg just above the malleoli. It is then carried obliquely downward over the anterior surface of the ankle and the dorsum of the foot, and around the ball of the foot, and back to the starting-point (Fig. 393). A second time the bandage is carried around the foot, and then two or three figure of eight turns are applied, each parallel to the preceding one, and slightly above it. A circular turn around the ankle completes the bandage.

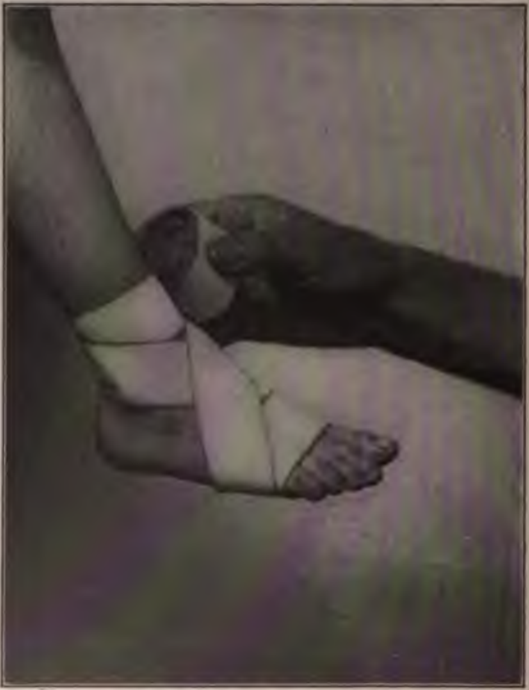

FIG. 393.—FIGURE OF EIGHT BANDAGE OF THE ANKLE, SHOWING THE COMPLETION OF THE FIRST FIGURE OF EIGHT TURN.

No. 61. Figure of Eight of Foot and Leg; a Two and One-Half Inch Bandage.—The area covered by this bandage is the whole of the foot and leg, with the exception of the toes and the heel. It is the usual bandage employed for ulcers of the leg, and for other lesions below the knee in which a complete bandage is required in order to prevent swelling. If the heel is covered, the foot is much more clumsy, and as the heel does not swell much even in cases of general edema of the leg and foot, it is usually better not to include it in the bandage.

The bandage is anchored by a circular turn carried around the base of the toes from the inner to the outer margin of the foot. Two or possibly three spiral turns are made around the foot, and then the bandage is carried around the ankle just above the heel, and brought back over the dorsum of the foot, making a figure of eight turn (Fig. 394). Another circular turn is made around the foot, and a second figure of eight turn around the ankle, higher than the previous one by one-third of the width of the bandage. If space permits, a third figure of eight turn may be applied. Next the bandage is carried spirally upward from the ankle, until the increasing size of the leg makes the lower edge of the bandage loose. It is then carried obliquely upward, across the front of the leg, and

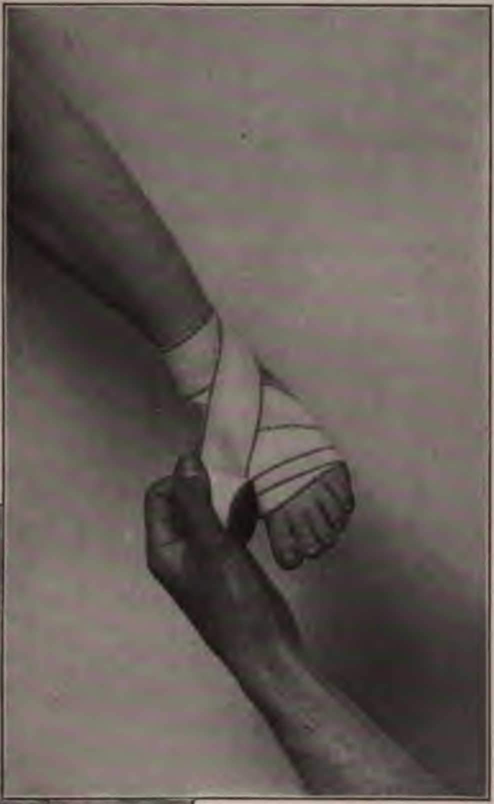

FIG. 394.—FIGURE OF EIGHT BANDAGE OF THE FOOT AND LEG, SHOWING THE BANDAGE OF THE FOOT NEARLY COMPLETED.

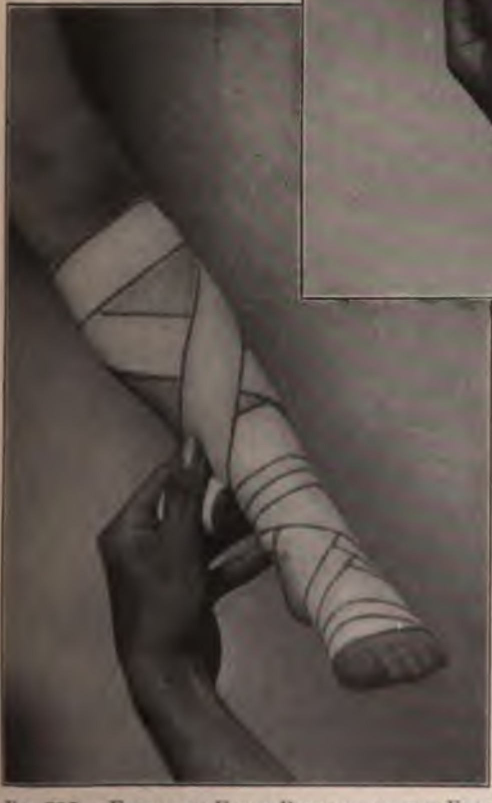

FIG. 395.—FIGURE OF EIGHT BANDAGE OF THE FOOT AND LEG, SHOWING THE COMPLETION OF THE FIRST FIGURE OF EIGHT TURN OF THE LEG.

then once around the leg just below the knee. As the leg tapers from the calf toward the knee, the slack in the lower edge of the bandage is taken up, not only by the change in direction of the bandage, but also by the change in the shape of the leg. The bandage is next brought down across the front of the leg (Fig. 395), and a circular turn is made; and then a figure of eight turn which overlaps the preceding one by one-third the width of the bandage below, but which exactly overlies it as it passes around the leg below the knee. A third figure of eight turn, with a circular turn at its upper and lower end, is also applied. After that the bandage is completed solely by figure of eight turns, and finished with a circular turn around the upper part of the leg. The upper margin of the bandage must not be high enough to interfere with flexion of the knee-joint (Fig. 396).

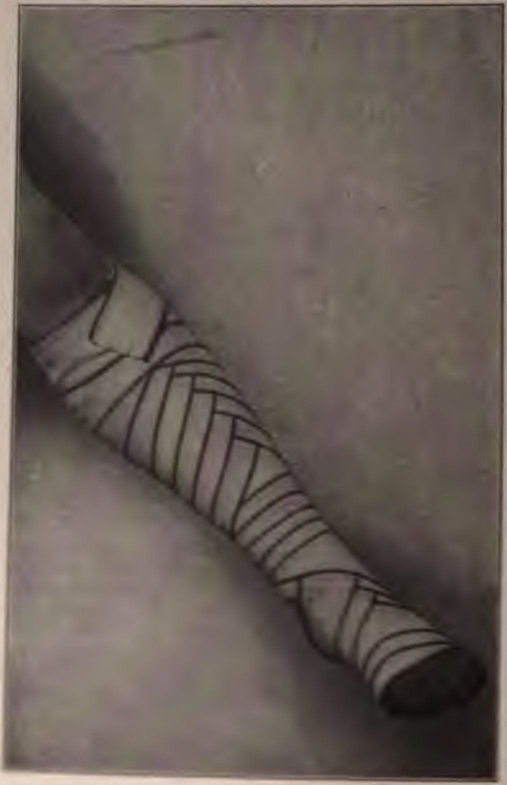

Fig. 396.—Figure of Eight Bandage of the Foot and Leg Completed.

A bandage of this character, properly applied, will remain in place indefinitely, and will give a firm, even pressure over the whole surface of the leg.

No. 62. Eccentric Figure of Eight of Heel, or Testudo Reversa; a Two Inch Bandage.—The area covered by this bandage is the whole surface of the heel and the ankle.

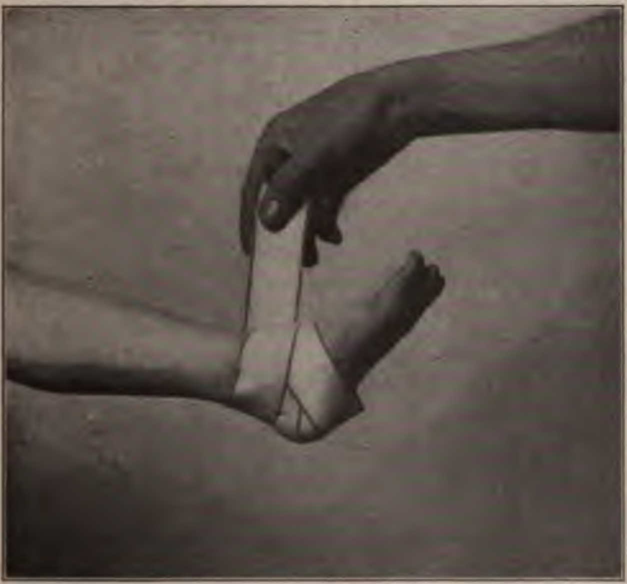

FIG. 397.—ECCENTRIC BANDAGE OF THE HEEL, SHOWING THE COMPLETION OF THE FOURTH TURN.

It is used to keep a dressing in place on the heel or to limit the motion of the ankle. For both purposes it is often combined with other bandages of the foot and leg.

The bandage is anchored by a circular turn from the anterior surface of the ankle directly around the heel. A second turn extends somewhat beyond the first one upward, where it passes over the heel, but crosses the first turn in the median line in front. The third turn extends beyond the first one downward at the heel, but crosses it in the median line in front. The fourth turn (Fig. 397) reaches still farther upward at the heel. These diverging figure of eight turns are continued until the whole heel is covered. Care must be taken not to pull too tightly the turns which cover the under surface of the heel, lest they be dragged forward thereby. If this bandage is combined with a bandage of the foot and leg (No. 61), or with the figure of eight of the ankle (No. 60), it should be the first one applied, so that the other bandage shall partly cover it and protect its weak parts.

No. 63. Modified Eccentric Figure of Eight of Heel; a Two Inch Bandage.—The area covered by this bandage is the whole surface of the heel and the ankle. It is used to keep a dressing in place on the heel or to limit the motion of the ankle. It is a more stable bandage than No. 62, and is less clumsy. It is often combined with other bandages of the foot and leg.

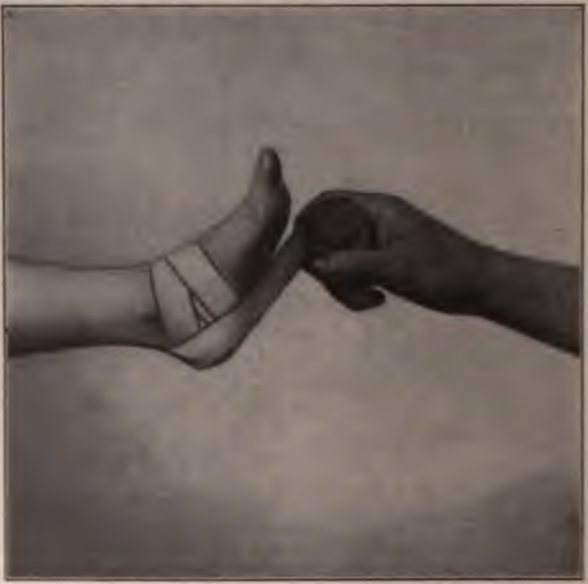

FIG. 398.—MODIFIED ECCENTRIC FIGURE OF EIGHT BANDAGE OF THE HEEL, SHOWING THE COMPLETION OF THE FIRST LATERAL BINDING TURN OF THE HEEL.

The bandage is started on the front of the ankle and is anchored by a circular turn directly around the heel. A second turn extends farther downward than the first turn, as it passes over the heel, but crosses the first turn in the median line in front. The third turn extends farther upward than the first on the heel, but crosses it in the median line in front. A fourth turn is applied, divergent downward. Thus far this bandage is exactly like No. 62. A fifth turn is started more divergent than the others, but when the bandage passes the posterior median line, above or below the heel, as the case may be, it is carried along the side of the heel and brought back to the starting-point without having encircled the ankle (Fig. 398). A similar loop is made around the heel from the other side, and one figure of eight turn of the foot and leg completes the bandage unless it is desired to add to it one of the other bandages of the foot and leg. These side turns hold the eccentric figure of eight turns firmly; furthermore they aid in the covering of the heel, so that far less bandage is employed. These are points of superiority which have well-nigh rendered obsolete the eccentric figure of eight bandage of the heel (No. 62).

No. 64. Spica of Foot; a Two Inch Bandage.—The area covered by this bandage is the whole surface of the foot and ankle, with the exception of the under surface of the heel. It is useful to keep dressings in place.

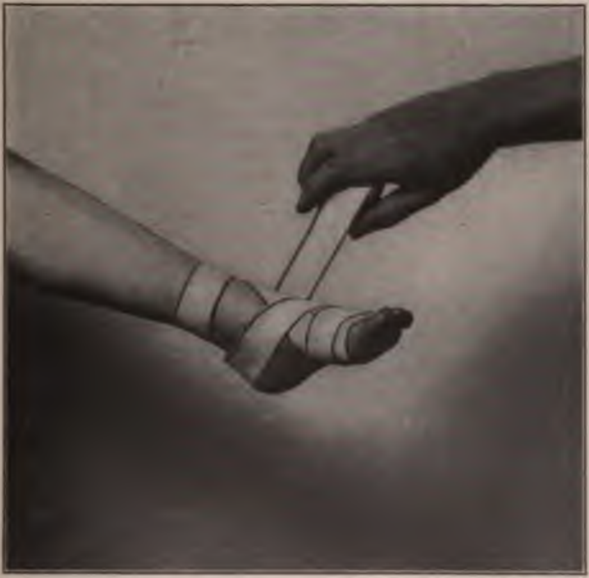

FIG. 399.—SPICA BANDAGE OF FOOT, SHOWING THE COMPLETION OF THE FIRST FIGURE OF EIGHT TURN AROUND THE HEEL.

The bandage is anchored by a circular turn around the ankle. It is then brought over the dorsum of the foot and carried once around the base of the toes. The instep is covered in by two or three spiral or spiral-reverse turns. The bandage is then carried across the back of the heel, over the dorsum of the foot to the base of the toes (Fig. 399), making a figure of eight turn. Two or three additional figure of eight turns are applied, each one higher on the ankle, and farther back on the foot. The bandage is completed by a circular turn above the ankle.

No. 65. Circular, or Spiral of Toe; a One Inch Bandage.—The area covered by this bandage is the surface of any toe, with the exception of its extremity. It is used to render the joints immobile or to keep a dressing in place. If it is desired to cover the end of one or more toes, the recurrent bandage should be employed. (Compare No. 47.)

No. 66. Spica of the Great Toe; a One Inch Bandage.—The area covered by this bandage is that of the great toe, excepting its tip, and a portion of the foot. It is used to keep a dressing in place or to immobilize this toe.

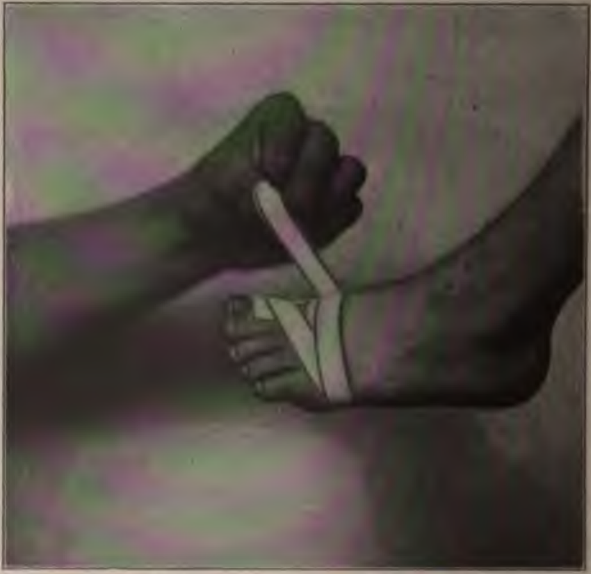

FIG. 400.—SPICA BANDAGE OF THE GREAT TOE, SHOWING THE COMPLETION OF THE FIRST FIGURE OF EIGHT TURN.

The bandage is anchored by a circular turn around the ball of the foot, and is then carried over the dorsum of the great toe to its terminal phalanx. Two spiral turns are applied to the toe, and one or two figure of eight turns around the base of the toe and ball of the foot (Fig. 400), with intervening circular turns around the ball of the foot.

No. 67. Complex Spica of the Great Toe; a One Inch Bandage.—The area covered by this bandage is that of the great toe, excepting its tip, a part of the dorsal and plantar surfaces of the foot, and a circle around the ankle. It is used to keep a dressing in place, or to immobilize the great toe. It is a more secure bandage than No. 66, especially in the case of persons with chubby feet.

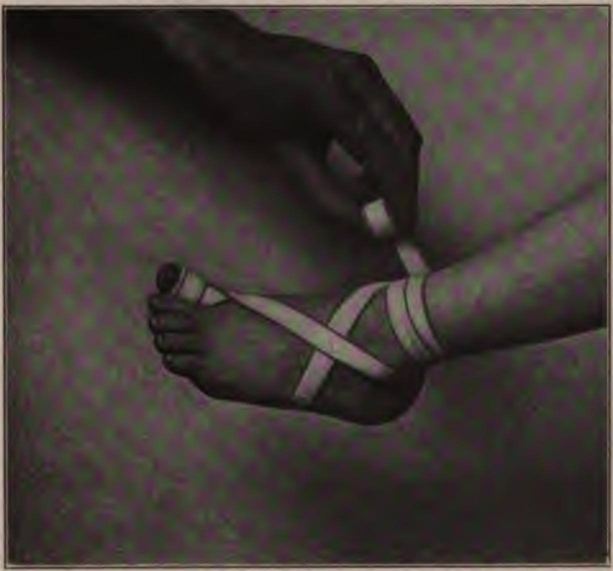

FIG. 401.—COMPLEX SPICA BANDAGE OF THE GREAT TOE, SHOWING THE COMPLETION OF THE FIRST COMPLEX FIGURE OF EIGHT TURN.

The bandage is anchored by a circular turn around the ankle, and is then brought spirally downward around the foot, crossing the dorsum from the inner to the outer side. It is then carried over the dorsum of the great toe to its terminal phalanx. Two spiral turns are applied to the toe, and the bandage is carried from the inner side of the base of the toe over the dorsum of the foot, and around the lower portion of the ankle (Fig. 401). As it is brought back to the toe the bandage is carried once around the foot, and then once around the toe. This complex figure of eight turn, with a single up loop and a double down loop, is repeated once or twice to complete the bandage, which may also be combined with No. 66.

No. 68. Recurrent Bandage of a Stump; a Three Inch Bandage, More or Less.—The area covered by this bandage is that of an amputation stump, together with a circle of the trunk, or of the upper portion of the limb. The bandage is used to keep a dressing in place or to make pressure upon the stump. This bandage is applied in accordance with the principles of the recurrent bandage of the finger, but because of the flabby nature of most stumps extra precautions are necessary to make the bandage firm. The bandage of the stump following amputation through the thigh is one of the most difficult to apply, as well as one of the most important. It will therefore be described.

If a dressing is employed, it should not extend so far up the thigh as to prevent the bandage from coming in contact with the skin above it. The bandage is started on the anterior surface of the thigh, carried directly over the end of the stump and up the posterior surface of the thigh, folded directly backward, and carried again over the end of the stump to the starting-point. These and subsequent loose ends of the bandage must be held snugly in place by the thumb and fingers of one hand while the bandage is applied with the other. If the thickness of the stump is too great to permit this, the patient or an assistant must hold these ends on either the anterior or posterior surface. Additional recurrent turns are now applied, each overlapping the previous one by one-third of the width of the bandage. When the end of the stump has been covered and there is an excess of bandage at its margins, the bandage is wound around the stump in the form of a figure of eight, covering this excess first on one margin and then on the other. (Compare the Recurrent Bandage of the Finger, No. 47.) Next, a slowly ascending spiral is applied, and completed at the upper end of the bandage with two or three circular turns, or with some figure of eight turns around the upper portion of the thigh and around the pelvis. (Cf. No. 49.) The bandage is made even more firm by four vertical strips of adhesive plaster or by rows of stitching. If carefully made such a bandage can be removed, and if necessary reapplied as one piece.

CHAPTER XXII

SURGICAL DRESSINGS

TEXTILE MATERIALS

Cotton.—During the history of surgery many materials have been used to remove the blood from a wound during operation, and to absorb discharges from a wound during its repair. Most of these have now only a historic interest, since cotton and gauze woven from cotton have superseded nearly all other materials for both of these purposes.

Cotton in its raw state has very little absorbent power because of the oil and gum with which its fibers are covered. When the cotton has been bleached by chemicals, and the oil extracted, its absorbent power is very great. This fact, together with its cheapness and lightness, the toughness of its fiber, and its ready sterilization by steam or dry heat make it almost the ideal material for surgical dressings.

Unbleached Cotton.—This is cotton in its natural state, freed from dirt, combed, and put up in pound rolls. It is non-absorbent, and has a greater elasticity than the absorbent cotton. It is therefore preferable as a padding for splints, and to diffuse the pressure of a non-elastic bandage; for example, in chronic ulcer of the leg (p. 525). These properties also render it superior to absorbent cotton for vaginal tampons, but for this purpose it is not so good as lamb's wool. It costs about thirty-five cents a pound, as supplied by the dealers in surgical dressings. A considerably cheaper grade is sold in dry-goods stores under the name of cotton batting for eighteen cents a pound. This usually contains more or less extraneous material.

Absorbent Cotton.—Absorbent cotton, as supplied by the manufacturers of surgical dressings, is freed from dirt, gum, and oil, combed and sterilized, and so wrapped in tissue-paper that with a little care it remains aseptic until it is all used. It is furnished in packages of various sizes, from a half ounce to one pound, costing thirty-five cents a pound in pound packages. On account of its lack of elasticity, it is inferior to unbleached cotton as a padding for splints, etc.

Dry cotton is not a suitable material to bring into contact with a wound either during operation or afterward. In the former case its fibers are likely to stick to the wound, and also to the fingers of the operator. In the latter case, if the discharge is small, it is likely to evaporate and seal the cotton to the wound or to the surrounding skin with a scab which is difficult of removal. If cotton is used for sponging, during an operation, balls of suitable size should first be saturated with saline or some antiseptic solution, and then squeezed dry. In this state the cotton will not stick to the wound nor to the fingers, and will soak up the blood instantly. Another method is to make cotton balls and cover each with a layer of gauze. If these are to be used in a moist state, the gauze is unnecessary; if they are to be used dry, they are inferior to the usual gauze sponges, and the saving in expense is insignificant. They are therefore not to be recommended.

When absorbent cotton is used as a dressing for wounds during the period of repair it should be separated from the wound by one or more layers of gauze. This may be first applied to the wound and a layer of cotton placed over it, or a thin pad of cotton may be wrapped in gauze exactly as one wraps a flat package with paper. A few stitches keep the gauze in position. Such a dressing, known as a combined dressing, is of regular use in most hospitals as a covering for wounds from which a free discharge is anticipated. A dressing of this sort applied at operation should not be too voluminous, for it is capable of absorbing a great amount of fluid. The writer knows of one instance in which a patient bled to death into such a dressing before the blood soaked through the dressing sufficiently to be noticed.

Cheaper grades of absorbent cotton of varying degrees of excellence can now be obtained in most dry-goods stores at prices ranging from twenty to thirty cents. One should not trust the sterility of such material, but should roll it into loose packages, covering each with muslin, and sterilizing them thoroughly before bringing the cotton into contact with a fresh wound.

Substitutes for Cotton.—Oakum, cotton waste, wood wool, etc., are preparations made of refuse hemp, or cotton fibers or wood which possess a considerable power of absorption, and which are suitable for dressing wounds with chronic discharge if rigid economy is necessary. They cost from ten to twenty cents a pound.

Lamb's Wool.—Lamb's wool has great elasticity, does not become soggy when exposed to moisture, and absorbs readily oily substances and glycerids. When cleaned and sterilized it is therefore an excellent material for vaginal tampons. It costs about two dollars a pound, but it is so light that an ounce package will make ten tampons of ordinary size.

Gauze.—Bleached absorbent gauze is the most important item in surgical dressings. The firmness of the material varies according to the number of threads to the inch. The quality should be selected according to the purpose for which it is desired. Thus a gauze which has 24 × 32 threads to the square inch is suitable for sponges or for dressings, but has not sufficient firmness to make a good bandage. On the other hand, a gauze with 40 × 44 threads to the square inch, used for bandages, is unnecessarily expensive when used for sponges or dressings. It is, however, an unwise economy to select for sponges and dressings a gauze with too large a mesh. Such a gauze absorbs so little that an additional quantity is required in every case, so that the total expense is very likely increased.

Gauze suitable for sponges and dressings, having 26 × 32 threads to the square inch, costs at the present time from four to five cents a yard, by the piece of 100 yards. This price is increased to eight or even ten cents a yard when the gauze is purchased in small pieces, previously sterilized and hermetically sealed.

Gauze for bandages, having 40 × 44 threads to the square inch, costs from five to seven cents a yard, by the piece of fifty yards.

Gauze Sponges.—A square yard of gauze will make sixteen small sponges. If larger ones are desired, the yard may be cut into four strips, and each strip cut into three pieces, thereby giving twelve sponges to the yard. A more convenient method is to take the piece of gauze as it comes folded back and forth in the yard lengths, and to cut twelve or fifteen thicknesses into nine inch squares. Half of these squares lying along the natural folds of gauze will then be of double thickness, and sponges made from them will be twice as large as those made from the single squares. This gives eight thick sponges and sixteen thin sponges to every two yards of the gauze, an average of twelve per yard, at a total cost of five cents a dozen.

Sponges are made as follows: Let the two yards of gauze be cut into sixteen squares. One of the raw edges of a center square is folded over for a distance of two inches, the two sides are then folded in, the first for a distance of three inches, and the second for a distance of two and one-half inches. This gives a strip of gauze seven inches long and three inches wide, with one folded end and one raw end. The folded end is folded over for a distance of two and a half inches. This end is opened, and the rough

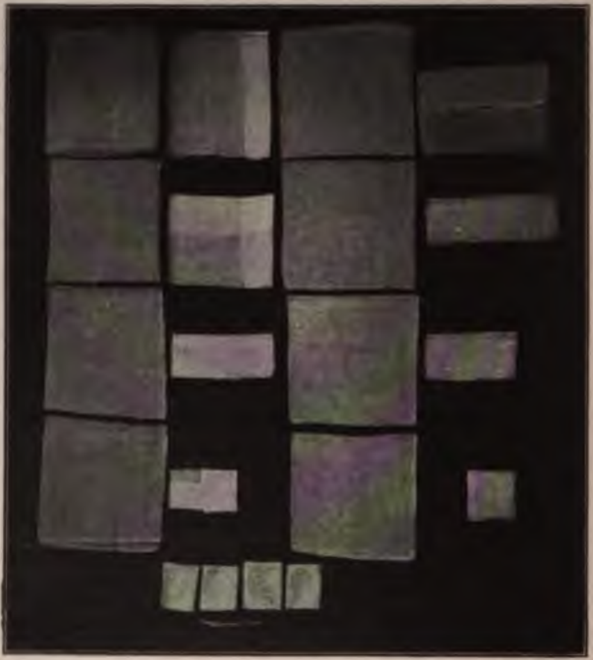

FIG. 402.—TWO YARDS OF GAUZE CUT INTO NINE INCH SQUARES TO MAKE TWENTY-FOUR SPONGES; EIGHT THICK AND SIXTEEN THIN ONES. The sponges are shown in various stages of preparation. The second vertical row from above downward shows the five steps in the making of a sponge from a single thickness of gauze. The fourth vertical row shows the four steps in the making of a sponge from a double thickness of gauze.

end is tucked into it for a distance of two inches. This gives a sponge measuring two and one half by three inches, composed of twelve thicknesses of gauze. The details are shown in the accompanying illustration (Fig. 402).

The nine inch squares which lie along the natural folds of the gauze have already one folded edge, hence one begins by folding in the two sides. This gives a strip nine inches long, three inches wide, having one folded end and one rough end. The folded end is now folded inward a distance of three inches. This end is opened and the rough end is tucked in for a distance of three inches. This gives a sponge measuring three inches square.

If one wishes to have sponges more nearly uniform in size, this can be accomplished by cutting the gauze into strips within eight inches of the natural folds. When the four strips are cut in the opposite direction there will be eight double pieces, measuring eight by nine inches, and eight single pieces, measuring ten by nine inches. When the preliminary two inch fold has been made, a single piece will then be the same size as the double pieces, and the completed sponge will have the same area, but not quite the same thickness as the double sponge.

When finished these sponges should be wrapped in muslin in packages of ten (or, as some prefer, of twelve), marked, and sterilized by steam.

Gauze in Strips.—Pieces of gauze one yard or two yards in length should be folded lengthwise three times, thus making a strip four and a half inches wide and eight layers thick. This strip should be rolled up, wrapped in muslin, marked, and sterilized by steam; or if preferred, yard or half yard pieces of gauze may be folded flat, wrapped up in similar packages, and sterilized.

These pieces of sterilized gauze take the place of sterilized towels and sheets to provide a sterile field around the minor operative wounds. In this way the bulk of the material necessary for the operation is considerably reduced.

Gauze drains are sometimes prepared beforehand, but unless medicated gauze is used, this is unnecessary, since a gauze sponge can in a moment be unfolded and converted into a drain by folding it lengthwise upon itself.

Gauze Bandages.—Bleached gauze is used for bandaging to a greater extent than any other material on account of its lightness, cheapness, cleanly appearance, and ease of application. It is made in various grades, but should contain not less than 40 × 44 threads to the inch. Such gauze costs by the piece about five cents a yard. It has the disadvantage that if torn into strips for bandages, the edges are ragged, and the finished bandage, no matter how carefully applied, does not present a neat appearance. In the manufactured gauze bandages which are cut on the thread, or are sliced from a tightly wound roll, this disadvantage is eliminated.

A gauze bandage is more porous than a muslin one, and is therefore cooler. It is not nearly so firm as muslin, so that more turns are ordinarily employed. The initial saving of expense per yard in making gauze bandages is probably lost in the application. Gauze has one distinct advantage over muslin in its ease of application. It is sufficiently rough to cling to itself, so that the turns of bandage do not easily slip out of place. Moreover, it is so loosely woven that it tends to fit the part, even though it is not applied with exactness.

Unbleached Muslin.—Muslin, bleached, or more often unbleached, is used for slings, for handkerchief or first aid dressings, and for roller bandages.

The muslin employed for bandages need not be of the best quality, since even the cheaper grades are sufficiently firm for the purpose. Such a muslin costs about eight cents a yard, by the piece. A muslin bandage has certain points of superiority over gauze. It is firmer and will maintain its shape for a long time if well put on. It is not so easily soiled, and can be washed and ironed and used again many times. This is often an item of importance in dressing chronic ulcers of the leg, etc., as patients with such diseases are often obliged to practise rigid economy. Muslin tears readily, with a fairly sharp edge, so that the homemade bandages present a good appearance.

Flannel.—The flannel selected for bandages need not be finely woven, but it should be all wool, in order to give the bandage its maximum of elasticity, which is the special merit of this type of bandage. The chief objection to a flannel bandage is its expense. It can be repeatedly washed and dried, provided lukewarm water and mild soaps are used, so that it is especially useful as a bandage of the legs, for chronic ulcer associated with edema. Whether red flannel or white flannel is employed is a matter of taste. The former has no superiority to the latter, and the dye sometimes comes out and stains the skin. Flannel bandages are easily torn, or they may be cut on the bias, the elasticity being thereby considerably increased. The latter form of bandage tends to become narrower with use—a point which should be taken into consideration in cutting the bandage. A patient should be directed to purchase two yards of flannel, every thread of which is wool, cut it on the bias into strips four inches wide, lap the ends of these, and sew them together flat, in order to avoid unnecessary ridges. This will give him three bandages, so that he can wash one while the other two are in use. A similar plan may be followed in making torn flannel bandages, although if one wants as many as six or eight, he will naturally use a piece of flannel as long as the bandage required. Flannel suitable to this purpose costs at retail about forty cents per yard, and is about twenty-eight inches wide.

Canton Flannel.—Canton flannel is used chiefly for making many tailed bandages and other bandages of the abdomen (No. 33, p. 642). It is too thick to make a satisfactory bandage of an extremity or the head. It has no elasticity. It tears well, and costs about twelve cents a yard at retail.

Stockinette.—Stockinette is a cotton fabric knitted in cylindrical form. It is sometimes employed for bandages on account of its elasticity. It can be washed and used repeatedly, but its thickness makes it a very clumsy material, and it is as expensive as flannel, costing twenty-five cents per bandage of five yards.

Large cylinders of stockinette are used instead of an undershirt to prevent a gypsum or plaster of Paris jacket from coming into contact with the skin. One yard or more of the material is cut off, and near one end two holes are cut for the arms. Thus all seams and buttons are avoided.

Bandages having considerable elasticity are cut from cloth woven like crape from a hard thread made from cotton or other vegetable fibers. These bandages are well suited to put in the hands of a patient, as they can be wound spirally around a limb, and will still exert a fairly even though light pressure. They can therefore be applied by those who know nothing of a spiral reverse or a figure of eight turn in bandaging. The elasticity of fabrics of this sort diminishes rapidly with use.

Silk.—Silk in the form of black ribbon makes an excellent bandage for the head or hand, and is often less conspicuous than a white bandage. This is a point which appeals strongly to most patients. The expense is not prohibitive in many cases. Suitable ribbon two inches wide can be obtained at twenty cents a yard, and for such a bandage four or five yards is frequently sufficient. Black muslin is similarly employed, but its appearance is far inferior to that of silk.

Rubber.—Rubber is used in two ways to give elasticity to a bandage. A long strip of sheet rubber (pure gum) is cut of the required width and rolled up into a bandage. If the rubber of which the bandage is made is new such a bandage is pretty expensive, but a two inch bandage, five yards long, costing eighty cents, will retain its elasticity for many months.

Rubber is also employed in the form of longitudinal threads to give elasticity to loosely woven cotton fabrics. These rubber threads break with use, so that the pressure obtained by such a bandage soon becomes unequal. It is very serviceable to reduce swelling in acute cases, for example, in synovitis of the knee. A two inch bandage, five yards long, costs forty cents.

There is one feature of a sheet rubber bandage which for certain purposes is a distinct drawback. It is impervious to moisture, and the perspiration is therefore retained under it. It is therefore well to remove it every night, if it must be worn for a long period of time, so that both bandage and skin can be cleansed by soap and water.

Crinoline.—Crinoline, either plain or cross-bar, is used alone or in combination with gypsum to make a rigid bandage. The very heaviest type of crinoline should be purchased for this purpose. It costs about nine cents a yard, and is a yard in width. It is easily torn into strips. It is important that the individual threads of the crinoline should be heavy, as this will give it more rigidity. Such a bandage, whether or not it contains gypsum, should be loosely rolled, so that the water will penetrate through it rapidly. The amount of starch which crinoline contains gives to the bandage after it has become thoroughly dry a considerable rigidity. Unfortunately, it takes from twelve to twenty-four hours for it to dry. During this time the part must be kept immobile, or else a weak joint will be made in the bandage. It is very light, and is therefore adapted for use upon children, and as a bandage of the head and neck after extensive dissection of cervical glands, etc.

Gutta-percha Tissue.—This material is gutta-percha spread into thin sheets, and treated in such a manner that its surface is not sticky. It is sold in sheets a yard square, and costs from fifty to sixty cents a yard, according to the weight, whether light, medium, or heavy. For certain purposes this is the best impervious material that we have. It is absolutely non-irritating to the skin or to a wound, or to a mucous membrane. It never adheres to a wound, and for that reason makes an excellent drain when folded upon itself to make a narrow strip, or when it is used to cover a slender roll of gauze (Fig. 306, p. 571). It is often employed in burns and skin-grafts, to keep the wounded surface moist, and to protect it from contact with the dressing. Unfortunately, it cannot be sterilized by heat, as it shrivels up when placed in water even a little above the temperature of the body. It is commonly sterilized by immersion in a strong bichlorid solution for some time before its employment. Before it is used it should be rinsed with saline solution or sterilized water.

Oiled Muslin, Silk, and Paper.—As now prepared, oiled muslin has none of the sticky, disagreeable features formerly attached to both oiled muslin and silk. It is flexible, opalescent, and costs about seventy-five cents a square yard. Oiled silk prepared in the same manner, but only thirty inches wide, costs a dollar a yard. These materials are serviceable to prevent evaporation from a poultice or wet dressing, and to prevent saturation of the bedclothing or clothing of the patient during the continuance of a wet dressing. Cheaper grades of oiled muslin can sometimes be obtained in dry-goods stores. Oiled paper makes a fairly good substitute for oiled muslin, and costs only three cents a yard by the roll of twenty-five yards. It is twenty-four inches wide.

LIGATURES AND SUTURES

In no part of surgical technique is sterility of so great importance as in the preparation of ligatures and sutures. They are implanted in wounded tissues, and any germs which they may contain are placed in the most favorable conditions for growth, being harbored in a foreign body (the ligature), and supplied with abundant nutriment in the form of extravasated blood and damaged tissue cells. Any material for ligatures or sutures, therefore, which cannot be sterilized with certainty should be thrown out of the surgical armamentarium. A number of surgeons have at one time or another decided that catgut fell under this ban, and have refused to employ it under any circumstances. It is now pretty generally admitted, however, that it can be sterilized by a number of methods with sufficient certainty to warrant its general employment.

Sutures and ligatures are primarily divided into those which are capable of disintegration within the tissues, and those which remain unchanged either permanently or for a very long period of time. The names absorbable and non-absorbable are applied to these two classes. All the non-absorbable materials can be sterilized by boiling in water or in a steam sterilizer.

ABSORBABLE SUTURES

Catgut.—Various animal tendons, strips of hide, and nerves have been employed as sutures and ligatures, but they have been almost entirely supplanted by catgut. It is cheap, it can always be obtained in any size, and in strands of sufficient length, and if properly prepared, it has great strength. Moreover, it is quickly disintegrated in the tissues, the ordinary sizes being wholly taken up in the course of a week or two, so that no foreign body remains in the wound indefinitely. Its one disadvantage is the fact that it cannot be sterilized by steam or boiling water, for in both of these it cooks to a jelly in a few minutes.

STERILIZATION OF CATGUT.—It can be boiled in alcohol in a water bath or sand bath, but as alcohol boils at 174° F., the temperature is not sufficient to kill all germs. This method is therefore unreliable.

Catgut may be sterilized by dry heat. Boeckmann's method is as follows: The catgut is soaked in ether one week to remove the fat. Single strands are then wound in rings, and each wrapped in paraffin paper and sealed in a paper envelope. The envelopes are placed in a dry sterilizer and heated to 300° F. for three hours on two successive days.

Catgut may be sterilized by chemicals. Claudius's method is the simplest. Commercial catgut without any preparation is wound in single layers on glass spools and dropped into a jar containing one part of iodin and one part of potassium iodid to one hundred parts of distilled water. The jar is tightly covered and allowed to stand for one week. For use the spool containing the catgut is removed and immersed in sterile water, in order to free the catgut from the excess of iodin. Spools which have been partially used can be resterilized until the catgut becomes brittle, which it is apt to do if it remains for more than three months in the above mentioned solution. After one week's immersion in the iodin solution, the spools may be removed and kept in alcohol. This is the simplest reliable method for sterilizing catgut in the office.

Catgut may be so treated with chemicals that it can be boiled in water. This result may be obtained by soaking the catgut in a solution of formaldehyde, but during the entire process the catgut must remain tightly stretched upon glass plates or large spools. A simpler method is that of Elsberg. The raw gut is freed from fat by immersion in ether or chloroform, or a mixture of one part chloroform and two parts ether. It is then wound tightly in a single layer on large glass spools, having a hole in each flange in which the ends of the gut can be tied. The spools are boiled for ten minutes in a saturated solution of ammonium sulphate with one per cent of carbolic acid. The spools are then removed with sterile forceps, rinsed for half a minute in warm sterile water, and placed in strong alcohol. Partially used spools can be resterilized, and the solution of ammonium sulphate in which they are boiled can be used indefinitely by the addition of water to take the place of that which has evaporated.

Catgut may be sterilized by boiling in some substance which has a higher boiling-point than water, and which at the same time will not so alter the catgut as to render it weak or brittle. One of the best substances for the purpose is cumol, which boils at about 330° F. The method is a little too complicated for office use.

Catgut may be sterilized by immersion in alcohol heated under pressure in order to obtain a high degree of temperature. This requires special apparatus, and is not a method suitable for general office use.

Catgut sold in sealed glass tubes is usually prepared by one of the two methods last mentioned. Catgut prepared in this manner costs from ten to twenty-five cents a ligature, the length of which varies from two to ten feet, according to the size of the tube. Envelopes, each containing one catgut ligature, about two feet long, cost from five to ten cents a piece.

Commercial catgut comes in coils of one hundred feet, costing in the sizes usually employed from fifty cents to one dollar a coil.

Chromic Catgut.—As stated above, plain catgut disintegrates in the tissues within a few days. Under certain circumstances this is a disadvantage—for example, in suturing the various fascial planes in order to cure a hernia, it is desirable that the sutures shall not give way until the granulation tissue becomes firm. For such purposes, catgut is prepared to resist disintegration by soaking it in potassium bichromate or chromic acid for twenty-four or forty-eight hours. A good method for office use is that of Elsberg, mentioned above, with the addition of one part of chromic acid to one thousand parts of the ammonium sulphate solution.

The longer the catgut remains in the solution of chromic acid or bichromate of potash, the harder it becomes, and the longer will it resist disintegration in the body. Chromic catgut or chromatized catgut is sold as "ten day catgut," "twenty day catgut," etc. These figures are not very reliable estimates, and should not be too implicitly depended upon. If the catgut remains too long in the hardening solution, it will become practically indestructible in the tissues of the body. Buried sutures of such material have often been removed months afterward without their showing the slightest change.

Kangaroo and Other Animal Tendons.—Kangaroo tendon was formerly employed a great deal for the deep sutures in hernia operations. The tail tendon of the kangaroo naturally splits into round cords which make excellent sutures. The fibers in the leg tendons have to be pulled apart mechanically, like the fibers in the tendons of the domestic animals. This gives a rough thread of uncertain strength. Many of the kangaroo tendons sold at the present time have very little value. Chromic catgut is gradually taking its place.

NON-ABSORBABLE SUTURES

Silk.—Twisted or braided silk is by far the commonest material employed for sutures. Some surgeons also employ it for ligatures on account of their fear of infection from imperfectly sterilized catgut. Black silk is preferable to white for most sutures, as the stitches are more readily seen and removed. Silk possesses the very great advantage of being easily boiled in water at the time of the operation. Any good black sewing silk answers the purpose satisfactorily, although many surgeons prefer to buy specially prepared and sterilized silk sutures in sealed glass tubes, costing from fifteen to twenty-five cents each.

For tying large pedicles, floss silk is often employed. This is a loosely twisted, very flexible, and strong thread, and answers the purpose remarkably well. The practise of mass ligation, however, is falling into disuse, as it is now generally recognized that the blood-vessels should be ligated separately, and the wounds in the other tissues should be closed by suture with finer thread.

Silkworm Gut.—This material, which is familiar to every fisherman, is obtained from the silkworm just before he spins his cocoon. It is at the time in a viscid state, and is pulled out into a long string and allowed to dry. This gives a hard, elastic smooth thread, almost like wire. These threads can be obtained in bundles of one hundred of dealers in fishing tackle. Such bundles cost from forty cents upward, according to the size and length of the individual threads. They can be sterilized by boiling in water or by steam; or they can be obtained in sealed glass tubes, costing from fifteen to twenty-five cents each. Silkworm gut is even less irritating in the tissues than silk, and is an excellent material to employ when deep sutures are required.

Horsehair.—Black or brown hairs from the tail of a horse make excellent sutures for skin wounds. They should be washed with soap and water, and then with alcohol. When needed they are easily sterilized in boiling water or in steam. They are not as strong as silk, but they are able to resist all the tension which any suture ought to have. They can also be obtained ready sterilized, six in a tube, at twenty cents; or dry in bottles or envelopes at a considerably cheaper rate.

Cotton and Linen Thread.—Although silk is generally used in preference to other manufactured threads, this is largely a matter of custom. Cotton or linen thread is easily sterilized by boiling, does not irritate the skin, and forms a perfectly satisfactory suturing material. No one need hesitate to use either in an emergency, nor, for that matter, in his regular practise. If a colored thread is used, it should have a fast dye, or else it should be boiled long enough to extract so much of the dye as is easily soluble.

Celluloid Thread.—Thread dipped in celluloid is often employed in operations upon the stomach and intestine on account of its impervious character. It is prepared in the following manner: A gray linen thread is boiled in one per cent solution of carbonate of sodium, wrapped in sterile gauze, dried in hot air, and then dipped in a solution of celluloid which is heated in a hot air sterilizer. It is dried and then placed in a sterile receptacle until wanted.

Silver Wire.—Pure silver wire is used for suturing bones, and also by some operators for sutures of the cervix, perineum, harelip, etc. The sizes usually employed are Nos. 24 to 30. Such wire costs about two dollars and fifty cents an ounce. It is also used in the manufacture of filigrees, employed in some operations for hernia. Other kinds of wire, and notably an aluminum bronze, are employed a good deal in Germany, but have never obtained much popularity in this country. Antiseptic powers are claimed for them by their advocates.

DRAINS

Glass and Metal Drainage Tubes.—The use of rigid tubes for drainage is not now so general as it was at one time. Glass tubes are easily cleaned both inside and outside, and it is easy to see whether they are clean or not; but owing to their rigidity, they are apt to cause pain, so that their field is a restricted one. There are instances in which it is important to use a tube which will not collapse, and then a glass, or hard rubber, or metal tube is employed; but the ordinary purposes of drainage are accomplished just as well by the use of a flexible rubber tube, or one of the still more flexible gauze drains. Glass drainage tubes cost from ten to forty cents each, according to their shape and size.

Soft Rubber Drainage Tubes.—Rubber tubing of various calibers forms a satisfactory material for drainage. Such tubing costs from seven to twenty cents a foot, according to the size and quality. The drainage tube can be prepared from a piece of tubing as follows: A piece of tubing of the required size, and having a smooth surface, is selected and cut to the required length. The end which enters the body is cut obliquely, and its sharp edge trimmed away with a pair of scissors. With a pair of curved scissors two or more oval openings are cut in the sides of the tube, beginning near its inner end, so as to permit the escape of pus in case the end of the tube is obstructed by contact with the tissues. The long axis of these openings is made parallel to the long axis of the tube, so that the tube shall not be unnecessarily weakened (Fig. 306, p. 571). A little practise will enable one to cut these openings neatly; or if one is very particular, they may be burned out with a Paquelin cautery. This gives an opening with a smooth rounded edge, like the opening of a velvet eye catheter.

Catheters make excellent drainage tubes. Additional holes should be cut in them if necessary. The rounded tip may be left or removed, according to circumstances. If it is allowed to remain, insertion of the drainage tube is thereby facilitated.

In draining large wounds, and especially if irrigation is to be employed, two tubes should be used and fastened together at the top by a safety pin (Fig. 102, *J*, p. 176). This insures freer drainage and allows the irrigating fluid to flow into one tube and out of the other.

Gutta-percha Drains.—Gutta-percha tissue is an excellent drainage material, especially for fresh wounds (see p. 570). It is employed in two ways: A piece of tissue, an inch or two wide, is folded upon itself until it makes a strip a half inch wide, more or less. Such a flat strip occupying very little space in a wound, and not adhering to the tissues, scarcely disturbs the aseptic healing of a wound. It is frequently inserted between the sutures of a wound at the close of operation in order to facilitate the escape of blood and serum. Moreover, if the operator is not sure of his asepsis, a drain of this character will allow the escape of any pus which may form, and prevent its burrowing in the deeper tissues. Two days after operation the wound should be redressed. If its appearance is satisfactory, the rubber tissue drain is removed, and the wound is allowed to unite primarily. If there is a seropurulent or purulent discharge the surgeon may decide to allow the drain to remain in place longer, or he may think it better to remove some of the sutures and introduce larger drains.

Cigarette Drains.—Gutta-percha alone gives a flat drain; combined with gauze it forms a round or oval drain. This is known as a cigarette drain. A roll of gauze of the required size is wrapped with rubber tissue, as the tobacco in a cigarette is wrapped with paper. Hence the name "cigarette" drain. The gauze should project slightly from the lower end of the drain, and should not be too tightly rolled (Fig. 306, p. 571). If the gutta-percha tissue shows a tendency to unwind, its edge may be stuck down with chloroform. Drains of this character are often employed in deeper wounds, for the same reasons that a flat gutta-percha drain is employed in shallow wounds; for example, after appendectomy, when there is a possibility that suppuration may form in the deeper tissues. Such a drain can be easily removed, since the only portion which can become adherent is the gauze at its lower end. For this reason the gauze should not project far beyond the gutta-percha tissue.

When gutta-percha tissue grows old it becomes brittle; hence it should be tested before it is used as a drain, lest a portion of the drain break off and remain in the wound. The tissue can be cut with scissors or torn. It has a distinct grain, so that in tearing it in one direction the motion should be quick; while in tearing it in the other direction, one must tear it very slowly in order to follow a straight line.

A finger from a rubber glove, or a finger cot from which the tip has been cut away, makes an excellent casing for a cigarette drain.

Gauze Drains.—Gauze is often used for drainage, either plain or impregnated with different chemicals. Its chief disadvantage is the fact that it adheres so closely to the surface of the wound. These adhesions give way in five days to a week, but by that time granulations may already have grown into the meshes of the gauze. In spite of this drawback, gauze is used for drainage far more than any other material, both because it is always at hand, and because it is so flexible. It is not, however, a good thing to use in the case of a sensitive patient on account of the pain caused by its removal. The most favorable time for the removal of a gauze drain is five or seven days after its insertion in a fresh wound.

The gauze drain may be of any size. A flat drain is formed by folding in the edges of a strip of gauze so that no loose threads appear. The two ends of the strip are then brought together, and the fold is inserted into the wound. This method facilitates the insertion of the drain, and also prevents loose threads from remaining in the wound when the drain is withdrawn.

A roll of gauze may be covered with gutta-percha tissue, making a cigarette drain (see opp. page). In this manner adhesions between the gauze and the surface of the wound are effectually prevented, and the drain can be easily removed at any time.

A Handkerchief Drain.—If the wound is a large one, and it is desired to keep it distended with a large quantity of gauze, adhesions may be reduced to a minimum by adopting the so-called Mikulicz method. This is also called a handkerchief drain. A single layer of gauze like a handkerchief is spread over the surface of the wound, and poked into all the recesses into which it is desired to carry the drains. Large flat gauze drains made in the manner above described are then carried into the different portions of the wound. The handkerchief limits adhesions between these central drains and the wound, so that they can be removed without much difficulty at any time. When they have been removed, the handkerchief itself being only a single layer, can be peeled off from the surface of the wound to which it is adherent.

Horsehair Drains.—Small drains may be made of threads, or horsehairs, by tying a number of them together, twisting the bundle, doubling it on itself, and allowing it to twist backward (Fig. 306, p. 571). Drains of this character are especially serviceable in scalp wounds, on account of the ease with which they can be inserted between the stitches.

SPLINTS

The materials in common use for rigid splints are wood, sheet metal, and wire cloth. Numerous composite materials have been made for splints, but they have never come into general use. The essentials of a good splint are rigidity, lightness, and cheapness. If, in addition to this, the splint could be molded, say by warming it to a temperature at which it could still be worked by the hands, or by immersing it in some harmless fluid, it would be ideal. Unfortunately, we possess no such material. Thus, hard rubber in sheets can be molded at a high temperature, but cannot then be handled. A composition made up of wood pulp and fiber becomes somewhat more flexible when soaked in water, and can be easily curved in one direction, as can pasteboard, but it cannot be curved in two directions, for instance, so that it will fit the flexed elbow. Modeling composition is easily molded, but it lacks strength.

Wood Splints.—Wood remains the common material for a ready-made splint, because of its lightness and easy accessibility. Bass wood an eighth of an inch thick answers very well. This wood is easily cut with a knife, and is not inclined to split. It has, however, no great strength. In most cases a splint of wood must be padded irregularly to make it conform to the shape of the part with which it comes in contact.

COAPTATION SPLINTS.—If a wooden splint is backed with a sheet of kid or adhesive plaster, and is cut or split longitudinally into a number of pieces, a coaptation splint is formed. This is of use to fit the limb. For example, after fracture of the center of the humerus or femur, two, three, or four such splints are often strapped around the injured portion of the limb.

Metal Splints.—Tin, aluminum, and other metals in the form of thin sheets are used for splints. On account of the difficulty of cutting them, they are not ordinarily employed except in a ready-made form. Such manufactured splints are extremely light and strong, and are much to be recommended if a person has to wear a removable splint for a long time. The splint should be perforated to permit the perspiration to evaporate, and made of a composition which does not easily rust. The chief objection to these splints is the difficulty in having on hand at the time it is wanted a splint that will exactly fit the patient. For this reason it is usually better in acute cases to mold a gypsum splint at the time it is required (p. 707).

There is one form of tin splint which the writer has used with such success that he can highly recommend it, even though its manufacture dulls the edge of a pair of scissors. It is cut from tin. The thin tin of the cracker box answers perfectly. If one has tin shears to do this work so much the better; but any heavy scissors will answer by cutting well up into the hinge. A pattern of the splint should first be cut out in paper, then the splint is cut from the tin. Its edge is turned over with a pair of pliers, or by gripping it with the handles of the bandage scissors, so that when it is applied to the hand it will not press into the skin. The proper curve is then given to the portion which fits the hand and the portion which fits the finger, and the two are bent at the required angle (Fig. 211, p. 426).

Wire Netting.—A coarse wire gauze, eight wires to the inch, such as is used for making sieves, can be used to make a posterior right angled splint for the elbow. A strip is cut eight or ten inches wide, and long enough to reach from the axilla over the point of the elbow, and to the tips of the fingers, if it is desired to support the hand. At a distance of eight inches from one end a transverse cut is made on either side, extending one-third of

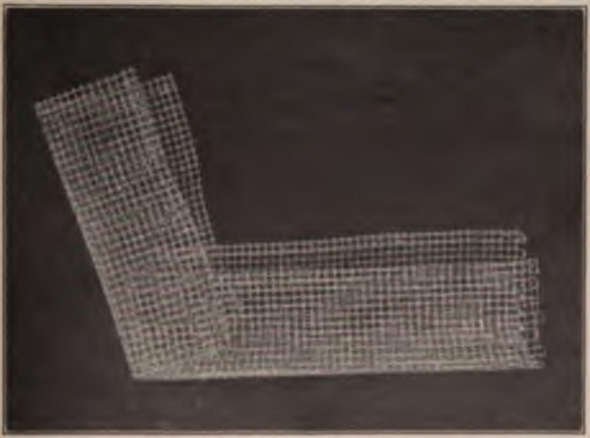

FIG. 403.—ANGULAR SPLINT MADE IN THE OFFICE FROM WIRE CLOTH WITH NO OTHER TOOL THAN A PAIR OF BANDAGE SCISSORS.

the distance across the splint. Each raw edge of the splint, for a distance of two wires, is now turned over and pounded down flat. The sides of the splint are then bent up so as to give the whole splint something of the shape of a half cylinder. It is next bent at the required angle, at the level of the two cuts that were made, the portion intended for the forearm passing within the sides of the portion of the splint intended for the upper arm. The splint is fixed in this position with wire or string, tied through at least two places on either side (Fig. 403). This makes a strong and light angular splint, although of course it does not fit the limb with any degree of exactness.

THE USE OF GYPSUM—OR PLASTER OF PARIS

Gypsum Bandages.—Gypsum, often called plaster of Paris, has virtually superseded such materials as dextrin and liquid glass, formerly employed for rigid bandages. Gypsum can be used in two ways: The dry gypsum and water can be stirred up until a cream is formed, and this can be rubbed into a gauze or muslin bandage after the latter has been partly or wholly applied to the limb. This is at best a crude method, and does not make the best use of the two materials, owing to their very imperfect union. The other and better method consists in incorporating the dry gypsum in a roller bandage, thoroughly wetting the latter and applying the bandage, the meshes of which are then full of moist gypsum. After the bandage is complete, the plaster sets, having taken up water of crystallization, so that in ten or fifteen minutes the bandage will be quite firm, and the patient can be moved, if necessary. It takes several hours for all the surplus water to evaporate, and until the bandage is quite dry it should not be subjected to any rough handling. If it is once cracked, a permanent weak spot is created, which can be only imperfectly overcome by a patch of additional plaster.

The strength of a gypsum bandage lies in the combination of the fabric which has power to resist tearing strains, but is very flexible, and in the plaster, which has no elasticity, and is very rigid, but which breaks easily if bent. It is the same principle of construction now so widely adopted in steel and concrete buildings. It is of the greatest importance that the gypsum used should be freshly calcined, since it gradually takes up moisture from the air, and becomes slake. Gypsum which is partially air slaked will take up water readily like so much sand, but no chemical change takes place. The gypsum never sets, in other words, and when it drys it has no more strength than dried mud. There is nothing in surgery more irritating than the attempt to immobilize a limb with such material. It is, therefore, the part of wisdom to test the gypsum beforehand, and if it is old to discard it. The best gypsum in the market is sold under the name of dental plaster. It comes in cans, holding six quarts each, and costs seventy-five cents per can. If a can is kept closed from the air, and in a dry place, it will maintain its freshness even after it has been opened for a number of weeks. It is not at all necessary, however, to employ this particular preparation. Every store where painters' materials are sold and every decorator and worker in plaster keeps a more or less fresh supply of gypsum. If the material is really fresh, it has a tremendous strength after it has set. I have put on bandages made from gypsum obtained at a paint-store that one could hardly crack with a hammer; and have attempted to put on others put up by the best surgical house in America, and bought of a respectable druggist, that were just a mess of wet cloth and white sand when they were finished. It is all in the age of the gypsum. As it is usually easier to obtain fresh gypsum than it is to obtain freshly made gypsum bandages, every one should know how to prepare his own. The method here given requires no especial apparatus, not even a bandage roller.

Preparation of Gypsum Bandages.—The articles required are two pounds of fresh gypsum, costing five cents, six or eight yards of crinoline, costing about sixty cents, a board, or the top of an old table, and a table knife with a straight back. The crinoline is torn into strips from two to four inches in width, according to the part of the body to be bandaged, and rolled. The end of a bandage is spread out upon the board for a distance of two feet. Three or four knifefuls of dry gypsum are dumped down upon it. The meshes of the crinoline are scraped full of the gypsum by drawing the back of the knife two or three times along it, and this portion of the bandage is loosely rolled up (Fig. 404). No central core is made, as when a muslin bandage is rolled by hand, as it is better that the center of the bandage should be hollow. Another two feet of bandage are spread out flat, scraped full of gypsum, and rolled up. This process is continued until the whole strip of bandage has been converted into a roll. The bandage is prevented from unrolling by a pin or an elastic band around it; or it may simply be wrapped up in paper. The tendency of a beginner is to put too much gypsum into the bandage.

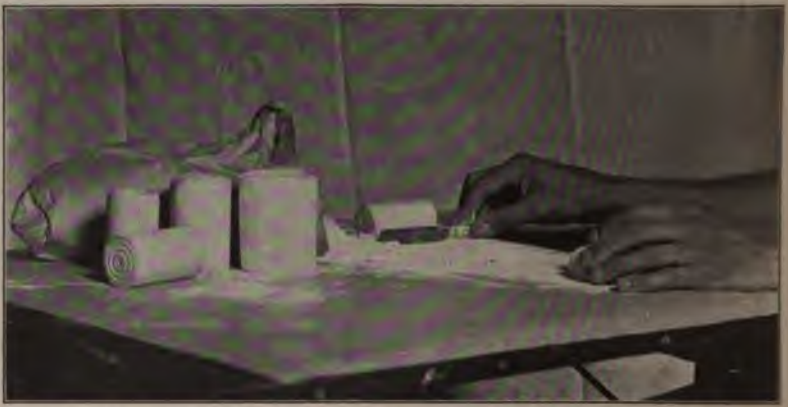

FIG. 404.—MAKING GYPSUM BANDAGES FROM CRINOLINE, SHOWING THE VARIOUS STAGES OF THEIR PREPARATION.

To make such a bandage does not require more than five minutes. It has two points of superiority over a commercial bandage. Crinoline is employed instead of gauze, so that the appearance of the completed plaster bandage is better and its strength is somewhat greater. Secondly, the bandage is loosely rolled, so that the water will permeate it quickly. It is impossible for a commercial bandage to be made in this manner. Shipping it about the country would rattle the gypsum almost entirely out of the meshes of the crinoline. Hence, the commercial bandage is made of gauze, is overfilled with gypsum, and is rolled tightly. Such a bandage does not wet quickly, and indeed should be loosely rerolled by hand before being dropped into water, if one wishes to get the best result from its use.

From four to six gypsum bandages are required to immobilize the ankle of an adult, for instance, after a fracture of the ankle. Four will give a light bandage extending from the toes to the knee, and six a heavy bandage covering the same area. There is an almost universal tendency to make a plaster bandage twice or three times as thick as it should be. The unnecessary weight loads down a patient, and renders the removal of the bandage unnecessarily difficult. Other fabrics than crinoline can be employed in the manufacture of gypsum bandages, provided their meshes are not too fine. Gauze answers very well. Recently a company has been introducing bandages in which a fine wire cloth is employed.

A Circular Gypsum Splint—or Plaster Cast.—The technique of application of gypsum bandages is important, if one wishes to get the best out of this material. The limb of the patient should be shaved, washed, and dried. It should then be covered with a thin layer of cotton or other elastic material. This may be held in place by a few spiral turns of a gauze bandage. The sheet wadding which is employed by dressmakers is an excellent material with which to cover the limb. It tears readily into strips, has a uniform thickness which it is difficult to give to absorbent cotton, and if wound spirally around the limb it will remain in place without a gauze bandage. Or the limb may be covered with a flannel bandage.

A deep bowl or jar containing sufficient warm water to more than cover the bandage when standing on end should be at hand. One loosely rolled gypsum bandage is placed on end in the water. Bubbles of air at once rise to the surface, and continue to do so until the bandage is wet through. It should then be lifted from the jar, squeezed partially dry with both hands, and applied. One should avoid milking the gypsum out of the bandage while it is in the water.

The application of a gypsum bandage is similar to that of a dry roller bandage, but there are certain points of difference. The gypsum bandage never slips, so that it is unnecessary to draw it taut. Tension during the application is, in fact, a disadvantage, since the unequal pressure tends to make ridges in the inner surface of the completed splint. The strength of the splint is in the material, and the aim should therefore be to apply it evenly. Reverses should never be made, since the end which they serve in a dry bandage is better accomplished in plaster by the use of "darts." A figure of eight of the type often employed in dry bandages when the upper circles of several figures of eight exactly overlie each other is seldom desirable. This is apt to make the splint thicker in places than in others, and it offers no advantages which cannot be obtained by the use of the short figure of eight with a dart.

The moistened bandage is anchored by a single circular turn, and is at once carried spirally upward. The overlapping should not be for more than one-half the width of the bandage. No traction should be applied in an attempt to make the two edges of the bandage lie smooth. As soon as any fulness of the lower edge is noticed, the bandage should be carried sharply upward and around the limb, and sharply downward again. The fulness in the lower edge of the ascending portion of this short figure of eight is taken up by the change in the direction of the bandage. The fulness in the descending portion is kept up out of the way by the thumb and finger of one hand, and is pasted smoothly backward against the rest of the bandage (Fig. 405). The dart thus made and folded back sticks instantly. Another spiral turn may now be introduced, and then a figure of eight, or the figures of eight

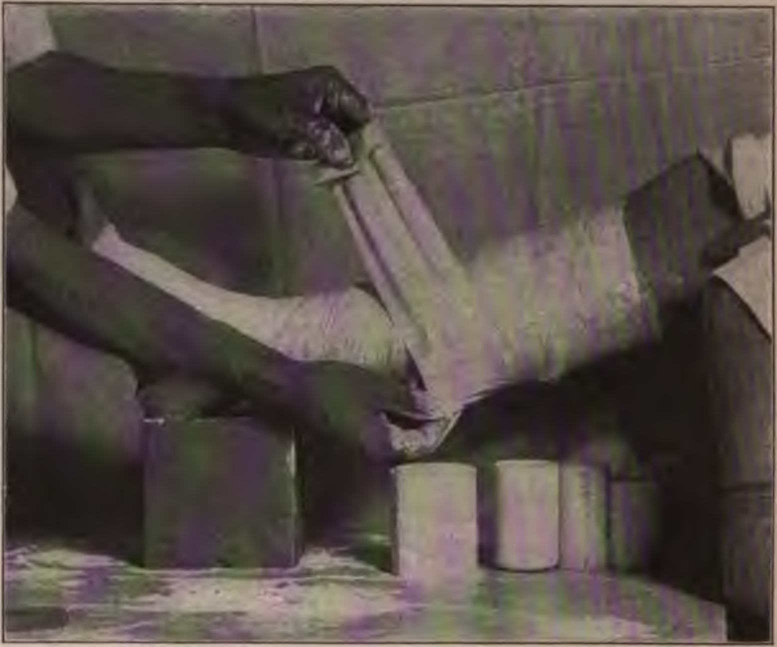

FIG. 405.—MAKING A "DART" IN A GYPSUM BANDAGE.

each with a dart in the downward turn may be applied without intervening spirals. In this manner any portion of any limb, no matter what its shape, can be evenly covered with the bandage, various turns of which should be well rubbed together before the gypsum has time to set.

In starting a second bandage, one should select the descending turn of a figure of eight some three or four inches below the upper margin of the first bandage. The second bandage should be directed downward, so that it will exactly follow the first bandage around the limb and upward. This avoids any break between the first bandage and the second. A sufficient number of figures of eight, or spiral turns, are then applied to complete the covering of the required area. If a thicker bandage is required, the third one should be begun at the bottom and should cover the area covered by the first one. The fourth one should overlap the third in the manner already described, and should cover the area covered by the second one. This method of application gives a more even and stronger splint than if each bandage were made to cover but a small area, and that to a considerable thickness.

If the gypsum bandages have been applied in the manner described, and care has been taken to make all lines exactly parallel that should be so, and to see that the pattern made by the intersection of the ascending and descending portions of the figure of eight turns lies exactly in the median line of the limb, the finished plaster splint will be much admired; but if the turns of the bandages have been irregularly applied, it may be better to obscure them by the application of additional gypsum cream. Some of the powdered gypsum should be stirred into water until thin paste is made. This should be rubbed evenly over the surface of the finished splint, and smoothed off by means of a wet cloth or compress. It is also a good plan to give the splint this smooth surface whenever it is likely to be soiled by escaping urine, discharge from a wound, etc.

It is of the utmost importance that during the application of gypsum bandages the limb should be held exactly in the position which it is desired to maintain. Flexion of a joint or correction of a misplaced fracture is possible while the plaster is still soft, but it breaks the commencing crystallization, and makes a weak spot in the splint. Furthermore, the position of the limb should be carefully maintained until the plaster has fully set. This requires perhaps ten or twenty minutes, according to the freshness of the gypsum. During this period the limb should be held, or so arranged upon loosely filled sandbags, or hard pillows, that its weight is distributed over a considerable surface, and does not rest upon a single transverse ridge.

It takes from twelve to twenty-four hours for a plaster splint to become thoroughly dry, and during this period the air should have access to the surface. Adjacent portions of the body, whether above or below the splint, may, of course, be covered.

As soon as the plaster splint has been applied, the circulation in the portion of the limb beyond it should be examined. Color should promptly return after pressure made with the finger is removed, and the toes or finger-tips should not be much colder than those of the corresponding extremity. If the quality of the circulation is doubtful, one should wait a few minutes to see if it improves. If it does not, the plaster splint should be split from end to end, and any underlying constricting bandage should be cut. This will relieve the undue pressure. It is not necessary to remove the splint. An outside bandage of gauze or other flexible material should be applied over it to keep it in position.

Removal of a Gypsum Splint.—Various saws and scissors have been devised for cutting through a gypsum splint. Most of them are extremely unsatisfactory. They work well enough on certain portions of the splint, but when it lies close to a bone beneath, or follows a convex surface, like the front of the ankle, these instruments give a great deal of trouble. On the whole, the most satisfactory tool is a sharp-bladed knife. This may be as large as a pruning-knife, or as small as an ordinary penknife; either one answers perfectly well if the blade is sharp.

The surgeon selects the line upon which the plaster splint is to be cut, and marks the same with a swab of wet absorbent cotton. He then draws the knife the full length of it, making only moderate pressure. He draws it through the line a second time, making a little firmer pressure. He then draws the cotton once more along the line, filling the cut with water. As the knife is drawn through the cut the third time, the blade is inclined sharply to one side. At the fourth cut it is sharply inclined to the opposite side. In this manner a gutter is cut out of the plaster, which will prevent the knife from "binding" in a deep cut. These various steps are repeated until the cut has extended through the plaster to the sheet wadding or absorbent cotton beneath. This material prevents the knife from cutting the patient unless an unreasonable amount of force is applied. By following this technique one can easily cut through a gypsum splint of the leg and foot in five or six minutes.

To Cut a Window or Fenestra.—This is necessary in order to permit the dressing of a wound without the removal of a gypsum splint, as in cases of compound fracture, etc. If there is more than one wound, it is usually better to apply molded plaster splints, both longitudinal and circular, rather than to cut numerous fenestræ.

In every case the site of the wound should be determined by longitudinal and transverse measurements made before the limb is bandaged. The appearance of the limb is so altered by the application of a plaster splint that it is unwise to trust to memory as a guide to the cutting of the fenestra. The gauze dressing which is used to cover the wound should correspond to the size of the fenestra to be cut, and it should be held in place by only one or two circular turns of bandage. This will make it unnecessary to cut through many thicknesses of gauze, and the plaster splint will fit the limb more accurately than it will if many thicknesses of gauze are wound around the limb.

The fenestra is marked out with a knife or pencil, according to the measurements taken before the limb was covered. The gypsum splint is then cut through layer by layer in the manner described for the removal of a splint. This should be done after the plaster has set, but before it has fully dried. The inner dressing may be removed immediately and reapplied, or it need not be disturbed until later. In every case a thick pad or compress should be used to fill up the gap made by the removal of the plaster. This should be held in place with a firm circular bandage; otherwise the portion of skin underlying the fenestra will likely become very edematous.

Molded Gypsum, or Plaster Splints. Splints freshly made from gypsum bandages and molded to the injured part before the gypsum has set, are of the greatest use in the treatment of fractures of the upper and lower extremity. They can be applied immediately after a fracture, since they do not dangerously interfere with the swelling of the limb as a circular plaster splint may do. They are sufficiently light and can be applied and removed at pleasure; while unlike wood, they can be molded to fit the curved portions of the body. Such splints, weight for weight, have not the strength of a circular plaster splint, nor are they to be recommended when there is a marked tendency toward recurrence of displacement in the case of a fresh fracture.

In most cases two molded splints are desirable. Each should be broad enough to encircle one-third or one-fourth of the limb to which it is to be applied. The curve thus given to the splint adds greatly to its strength. Its length should be determined by measurement before the splint is made. For light splints a single roller bandage suffices, while for heavier ones two, or even three, may be required. In some instances additional circular splints are employed to fix the lateral ones in place and make them more rigid.

The required length of the splint is marked on a board or marble slab. The gypsum bandage is sunk in water, and after it ceases to bubble it is lifted out and squeezed partially dry (see p. 703). Its loose end is then held to the board by the thumb and finger of the left hand, and enough of the bandage is unrolled to pass the second mark upon the board. The unrolling should be done in the air, so that when the bandage is allowed to sink upon the board, it may be free from longitudinal wrinkles. The left hand, now free, takes the bandage from the right, and carries it toward the left until the fold of the bandage just lies on the right hand mark. The thumb and finger of the right hand prevent it from being drawn beyond this mark, and the left hand unrolls sufficient bandage to pass the left hand mark. This second layer of bandage is allowed to rest upon the first, and the two are rubbed together by a stroke of the right hand made from left to right before the bandage is changed from the left hand to the right. The bandage is carried backward and forward in this manner until the splint has the required thickness. A little time is saved if an assistant guards the turns of the bandage at one of the marks, and rubs the various layers together.

The completed splint should be at once molded to the bare limb. Hairs should have been shaved off, or pasted to the skin with vaseline, so that they will not become imbedded in the plaster; or the splint, before its application, may be lined with a single strip of canton flannel, which should slightly project at the edges and ends. The splint is applied, molded by the fingers to fit the part, and held in place by a gauze bandage until it sets. It may then be left in place, or the surgeon may prefer to remove it, and to lay it aside a day until it becomes thoroughly dry before reapplying it. The latter is a good plan to follow in the late treatment of fractures. The splint or splints may then be covered with some cotton or woolen fabric stitched so as to make a complete casing. This should be just loose enough to follow easily the curves of the splint.

If two or more splints are to be used, the second should be made as rapidly as possible, so that it may be applied before the first has time to set.

A molded plaster splint may also be made as above described, except that a fine wire cloth is substituted for the crinoline in the preparation of the bandage. The splint so made is considerably stronger than one in which crinoline is employed.

Reenforcing a Gypsum Splint.—It is often desirable to increase the strength of a molded or circular gypsum splint in order to prevent it breaking at some point where the strain is greatest; for example, opposite the groin in the case of a spica of the groin.

The material used for reenforcing the gypsum splint is generally a light strip of metal, measuring half an inch or more in width and one-thirty-second of an inch or more in thickness, according to circumstances. A coarse wire cloth cut into strips, or even thin strips of wood, may also be used for the purpose. The technique of application is as follows, in the case of a circular bandage: The limb is encased with protective material (see p. 703), and it is then bandaged with gypsum bandages until one-half of the required number of bandages has been employed. The thin metal strips are then bent until they accurately fit the part in a longitudinal direction. They are covered in by the remaining gypsum bandages, and the dressing is complete.

In certain cases it is desirable to give the metal strip a greater hold upon the plaster; for example, if a circular splint is made in two portions, with a gap between them to permit of the dressing of wounds, or of extension of the limb in cases of compound fracture. Under such circumstances a piece of tin should be riveted to either end of the metal strip, and slightly curved to conform to the shape of the limb.

If the reenforcing strips of coarse wire cloth are used in a molded plaster splint, they should be shaped to the limb before the splint is made. Such reenforcing material can then be incorporated in the molded splint as the latter is made.

Gypsum or Plaster Casts.—It is often desirable to obtain a cast of some portion of the body for purposes of demonstration, or for means of comparison in order to show the change produced by a growth, or during treatment, or as a guide to the manufacture of orthopedic apparatus. Such a cast may be obtained in several ways; thus every circular plaster bandage, when removed, is a mold of the part with which it has been in contact. It is usually, however, a very imperfect mold, since even with the greatest care it is impossible to make the bandage press equally upon every portion of the skin. A better method, therefore, is to employ a semifluid cream, or paste, made of powdered gypsum and water. The portion of the body of which a cast is desired is half submerged in this paste, and kept there until the latter sets. Its upper surface is then greased, and a sufficient amount of paste is added to completely surround the portion of the body in question. When this has also set, the two half molds are removed. When they are applied together, they form a complete mold, from which a more or less perfect cast can be obtained, according to the skill of the workman.

It is often necessary to obtain a cast of the foot from which to make braces for the correction of flatfoot. To do this successfully requires not a little skill, and the description of the technique employed will enable one to make a cast of any other portion of the body in a similar manner. The directions are as follows:

Remove by shaving or clip short the hairs on the dorsum of the toes and foot. Oil or grease every bit of the skin, so that it may not adhere to the plaster. Let the patient lie down with the outer side of the affected foot downward. Make an oval ring with a heavy bath towel, and cover it with four or five thicknesses of newspaper. Place the foot in the depression thus caused, and fill the depression with the gypsum cream or plaster until it rises to the level of the second toe, and is half way up the heel (Fig. 406). This gypsum cream is made by stirring freshly calcined powdered gypsum into warm water. The water should not be too warm, as the slaking of the gypsum increases the heat somewhat. It is a matter of nice judgment to determine when the cream is just thick enough. As a general rule it is better to have it too thin than too thick, since if it will not pour readily, it may not flow into all crevices, and air spaces will remain between the skin and the plaster, and an imperfect mold will result. If the cream is too thin, it does not set readily, and flows away from the foot. When of just the right consistency it can be heaped up around the foot, and will remain there while adapting itself to the shape of the latter.

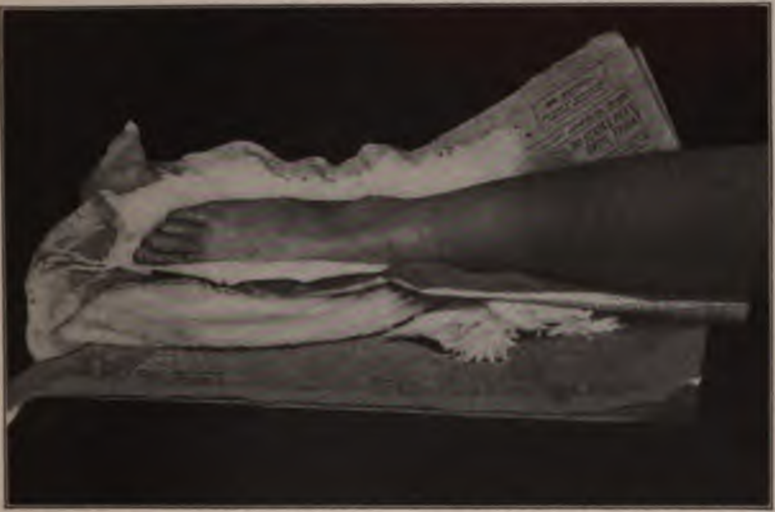

FIG. 406.—MAKING A CAST OF THE FOOT WITH GYPSUM. THE MOLD HALF COMPLETED.

When the first half of the mold has set, its upper surface should be oiled or greased, so that the second half may not stick to it. A fresh lot of gypsum cream is prepared and is poured very slowly over the exposed portion of the foot. Care should be taken to see that it is everywhere of sufficient thickness to permit of its removal without breaking.

When the second half of the mold has set, it is trimmed down somewhat, so that its area of contact with the first half shall be reduced to a zone about half an inch wide. It is then carefully wedged up from the first half and removed. The foot is then withdrawn from the first half of the mold, and both parts are set aside to dry (Fig. 407).

When the mold is dry, or even before it is dry, if one is very careful, its whole interior is oiled or greased and its two halves are tied together in their correct relation. Its interior is then filled with a gypsum cream somewhat thinner than that employed in making the mold. The mold should be held in such a position during this process that air may find ready exit. Mold and cast should be set aside to allow the latter to become thoroughly hard. The molds are then broken and removed, and slight irregularities in the cast are trimmed off, or filled in with plaster cream, as the case may require. In the case of flatfoot it is usually customary to partially correct the deformity in the cast by shaving away some of the plaster from the under or inner side of the cast before sending it to the brace-maker. The area which the brace should cover should be marked on the cast with pencil.

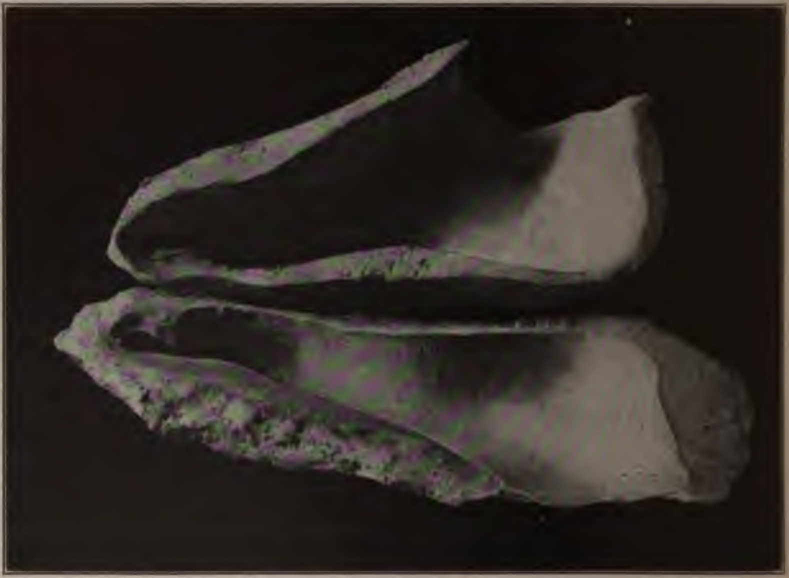

FIG. 407.—MAKING A CAST OF THE FOOT WITH GYPSUM. The two halves of the mold have been removed from the foot, trimmed, and set up to dry.

Plaster Jacket.—A plaster jacket is merely a heavy circular gypsum splint of the trunk, or possibly of the trunk and head. It is usually applied for some condition, such as tuberculosis of the spine, which renders it necessary to continue the treatment for many months; hence, the jacket should be made with great care.

In most cases it is desirable that the patient's spine should be fully extended during the application of the jacket, and until the gypsum has set. This is accomplished by suspending the patient from a tripod, or from a hook in the ceiling, a part of the weight being borne upon straps which pass under the arm, but as much as possible of the weight resting on straps passed under the chin and occiput. The patient should wear a light balbriggan undershirt or, still better, a cylinder of stockinette, with two holes for the arms. In either case a strip of gauze bandage should be placed between the stockinette and the back, and another one between the stockinette and the chest, to be used as scratching strings. These will add greatly to the patient's comfort, and will serve to remove a considerable amount of cast off epithelium.

Bony prominences, such as the spinous processes of the vertebræ, should be protected from undue pressure by strips of saddler's felt placed on either side of them. Bandages employed for the jacket should be three inches in width. From six to twelve are needed, according to the size of the patient. The manner of their application is in general that of an ascending or descending spiral bandage of the chest and abdomen, with additional forward and backward turns over the shoulders, or combined with the figure of eight bandage of both axillæ (p. 618). It is of the greatest importance that the various layers of bandage should be thoroughly rubbed together as they are applied.

After the gypsum has set, but before it is fully dry, the upper and lower margins of the plaster jacket and the holes for the arms are trimmed out smoothly with a sharp knife. The stockinette is then turned over these raw edges, and held in place by stitches passing between the upper and lower margins.

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